Report of the Royal Commission
on Vaccination
5 reports (in one)

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CINATION COMMISSION.

FIRST REPORT

OF THE

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PPOINTED TO I E INTO THE SUBJECT OF

APPENDICES.

t by Command of Her Majesty.
1889.

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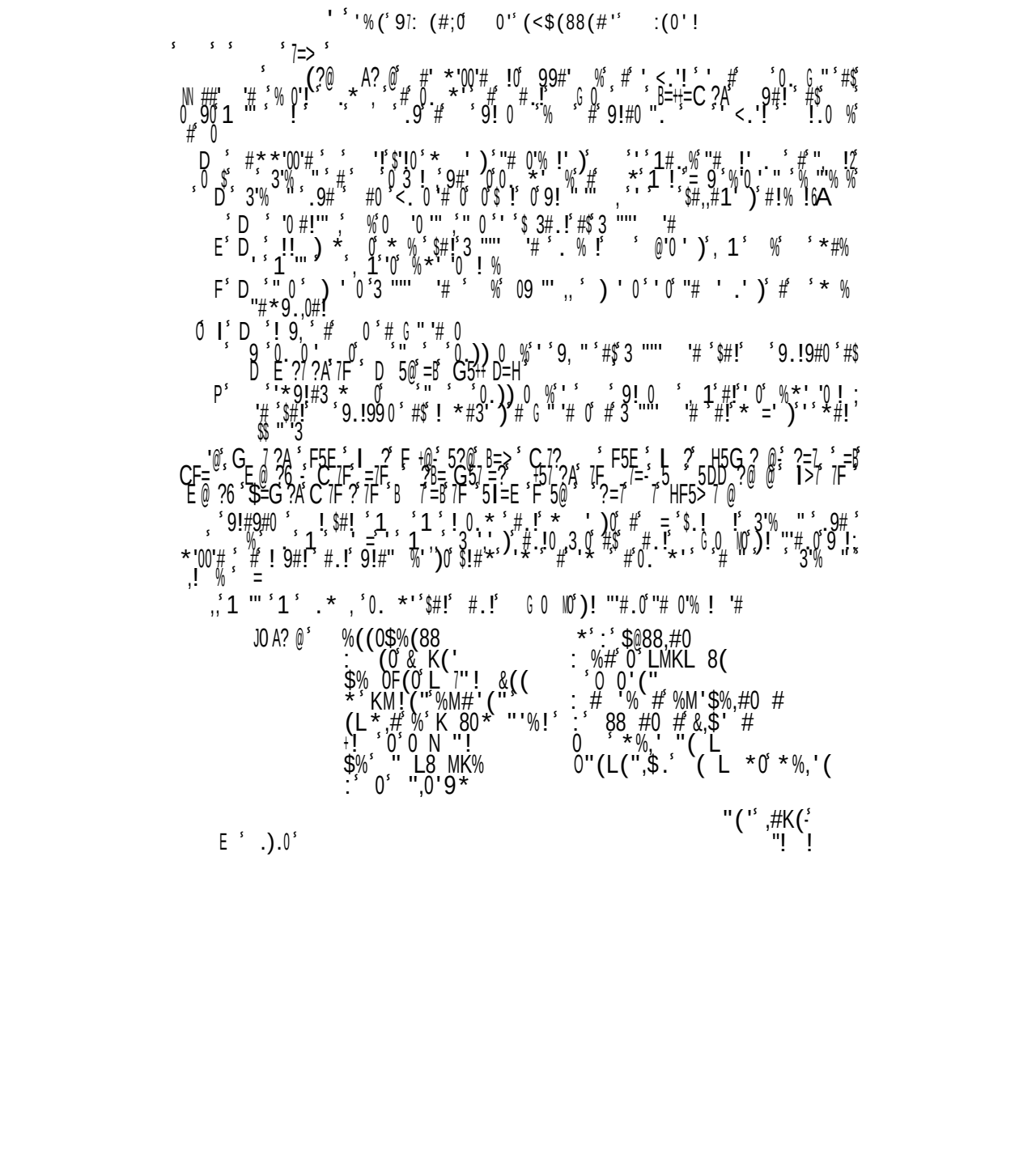

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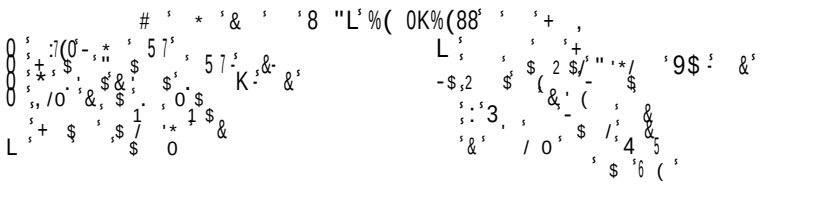

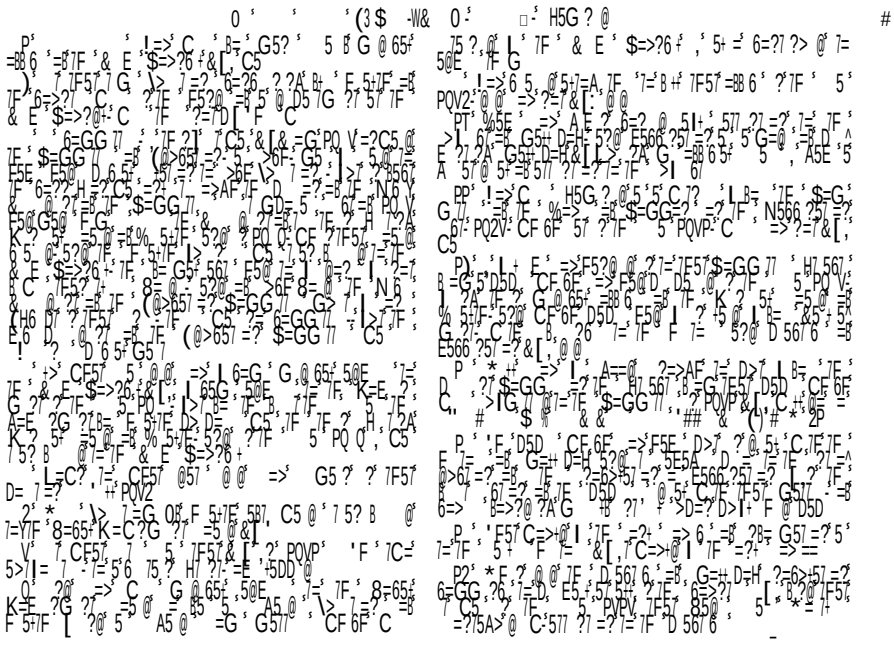

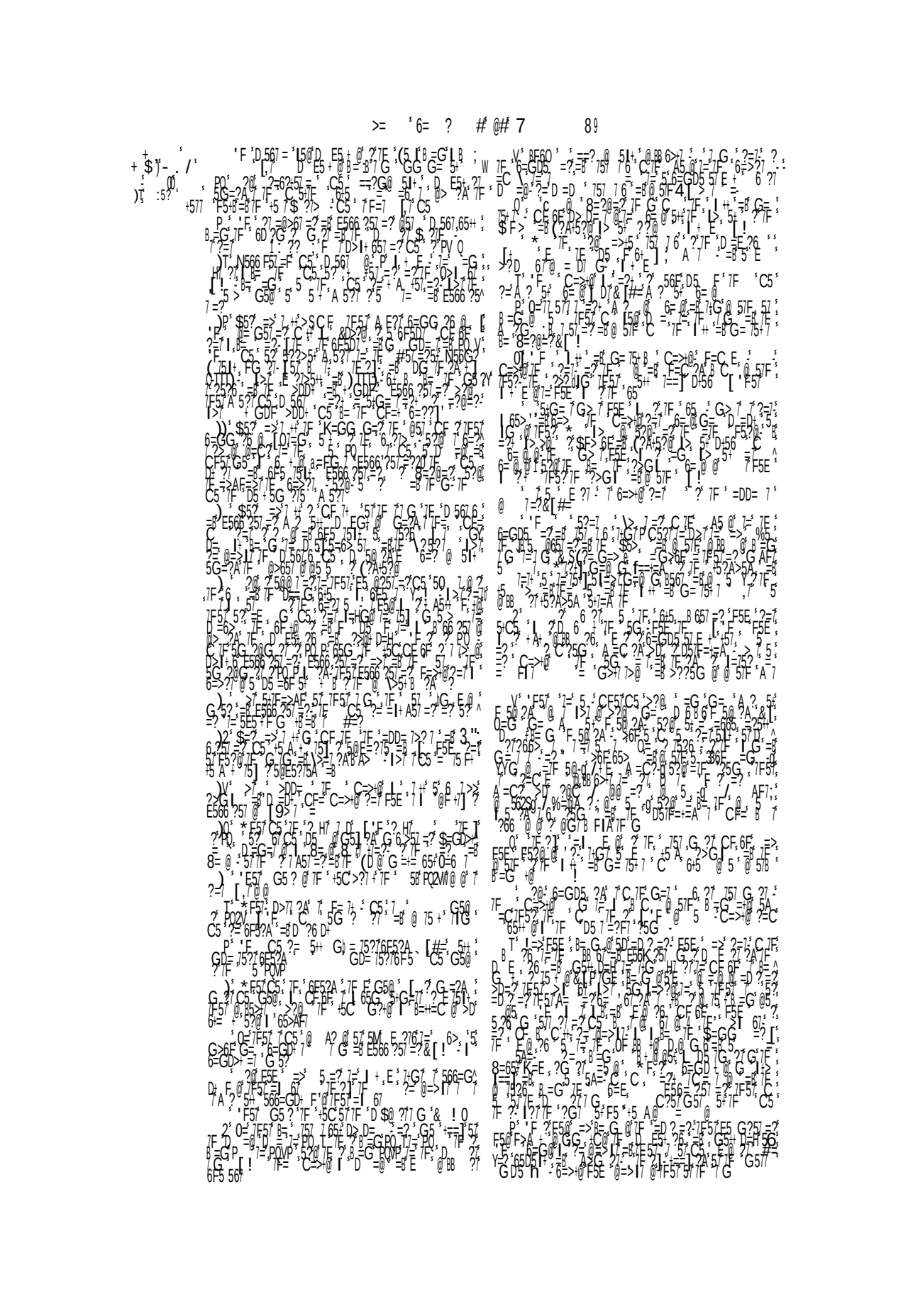

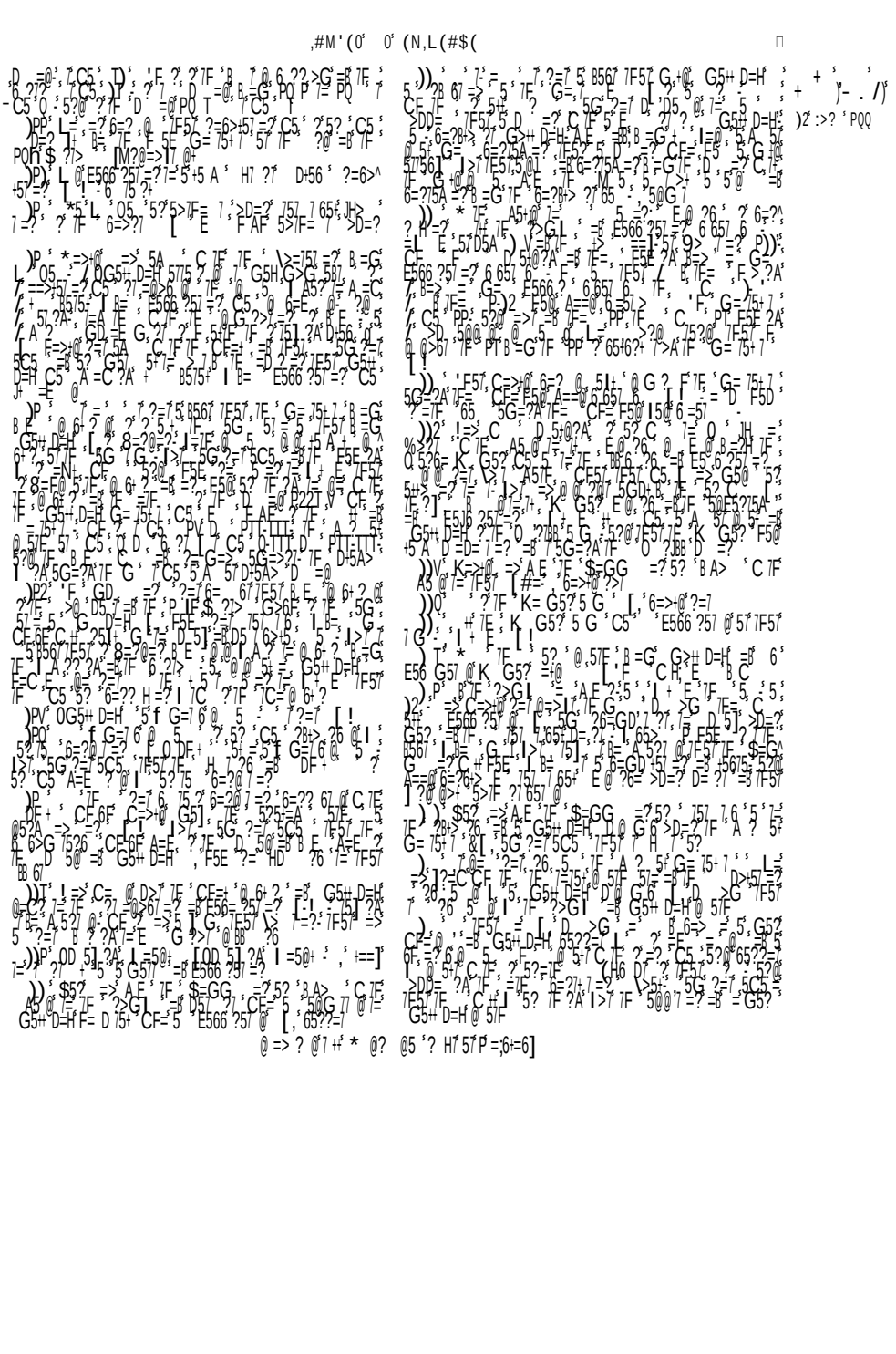

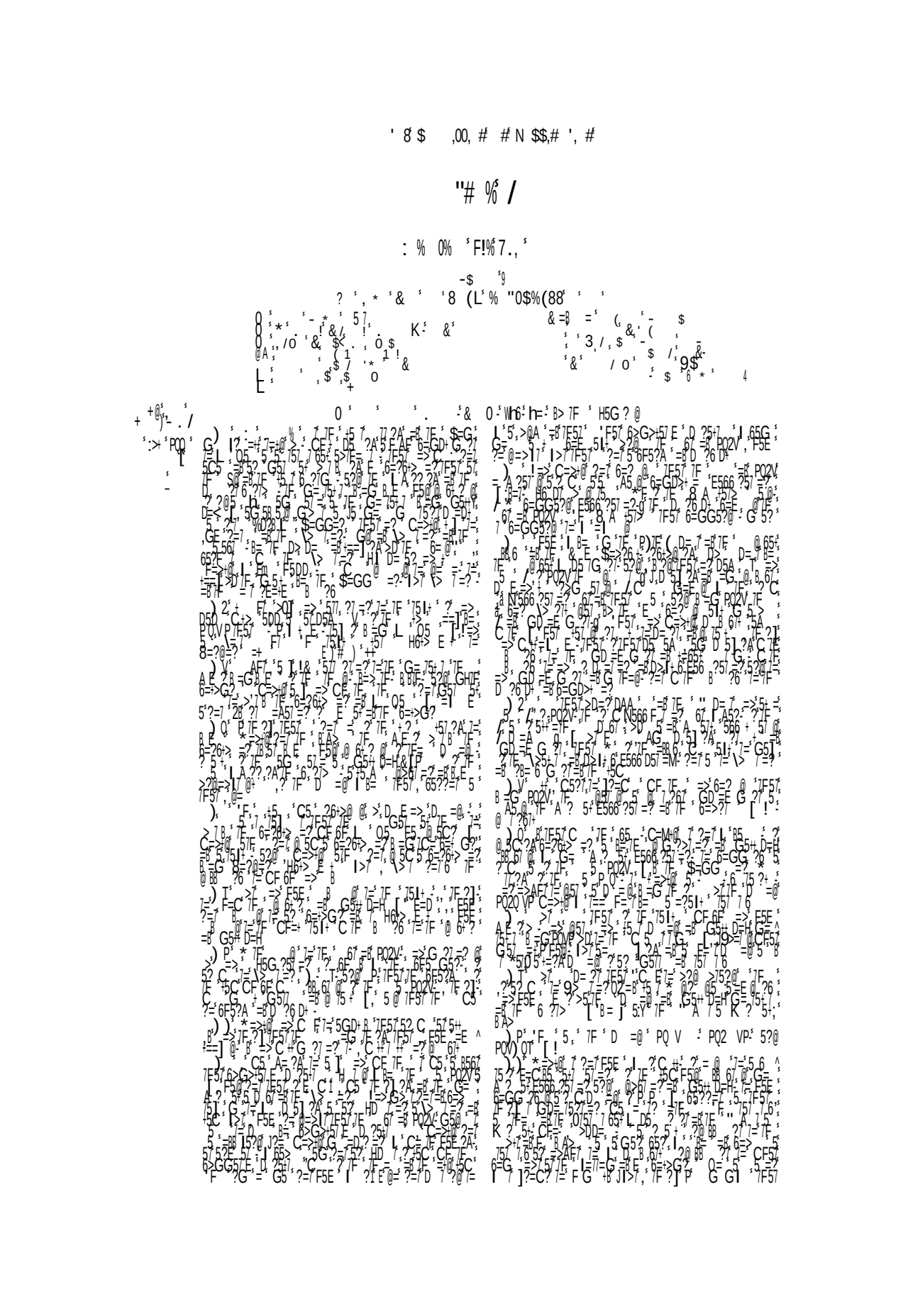

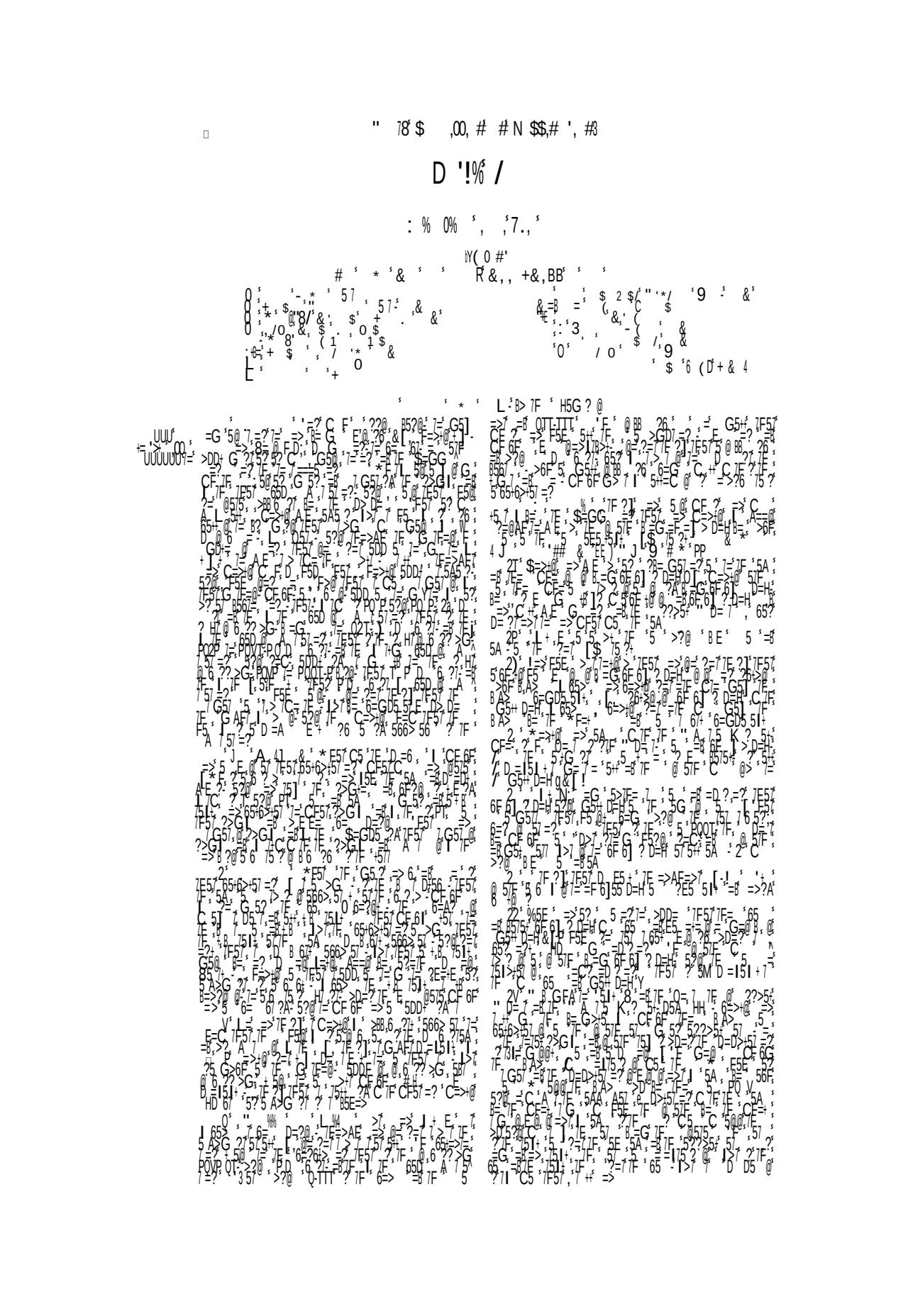

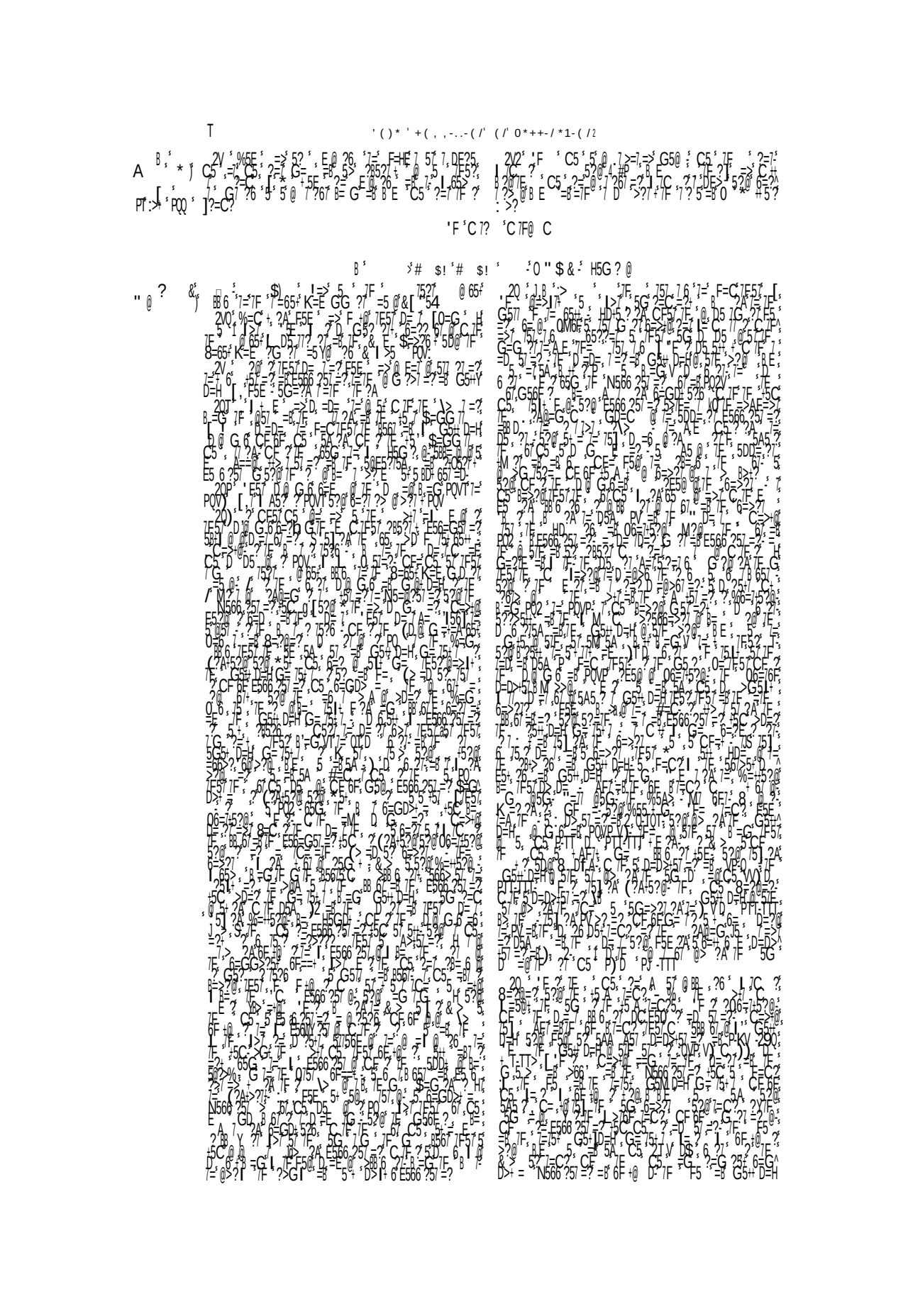

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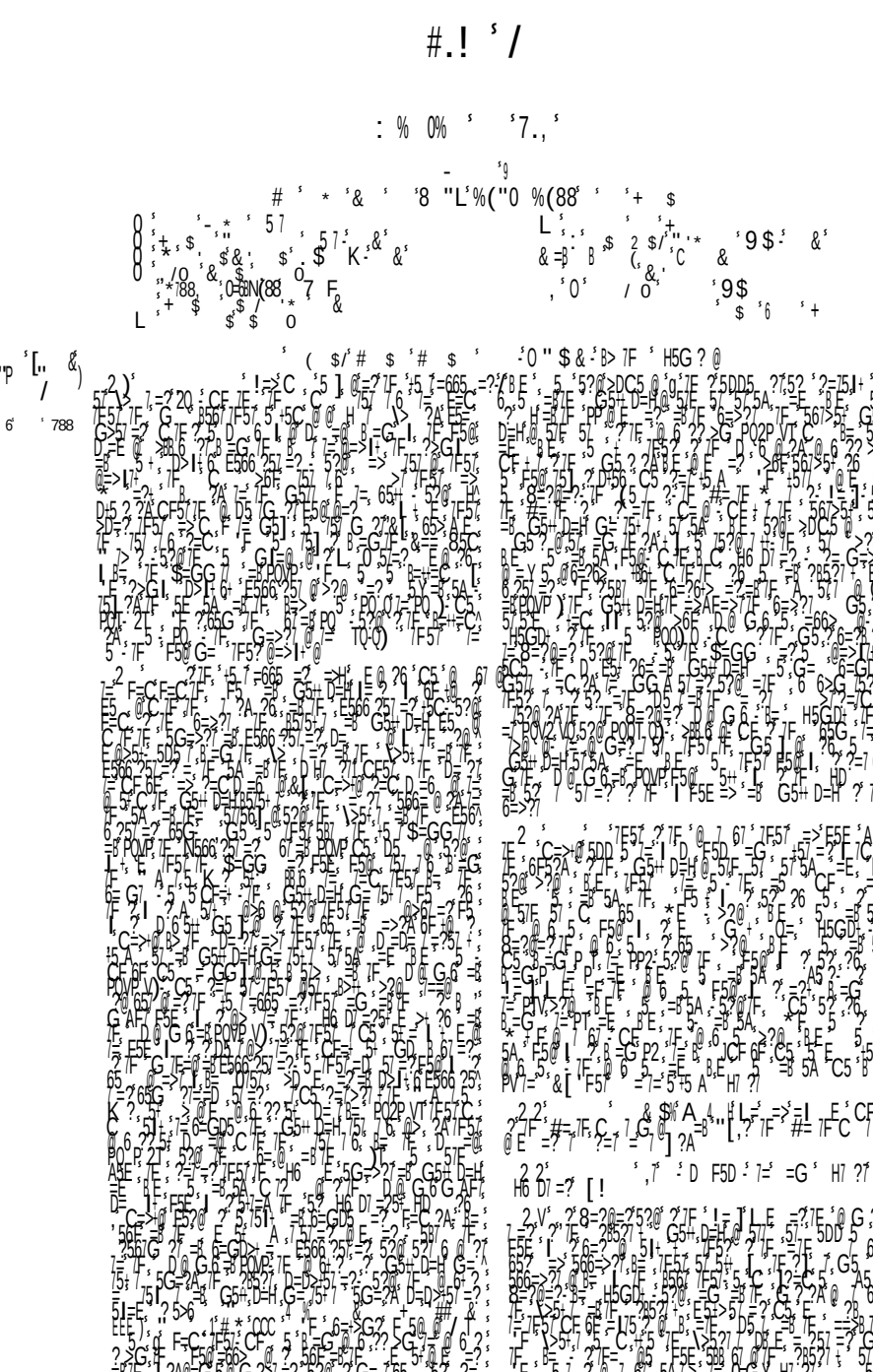

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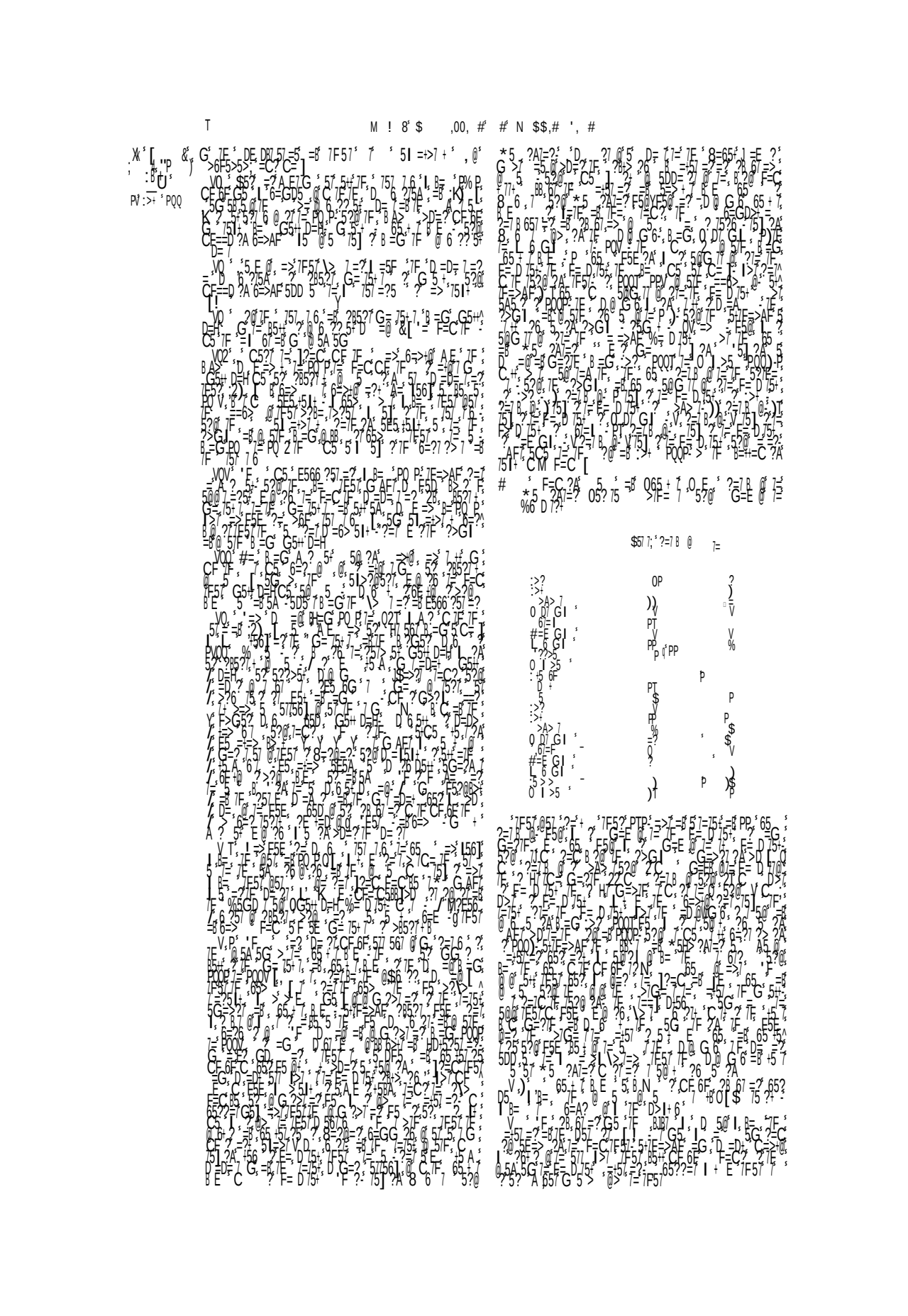

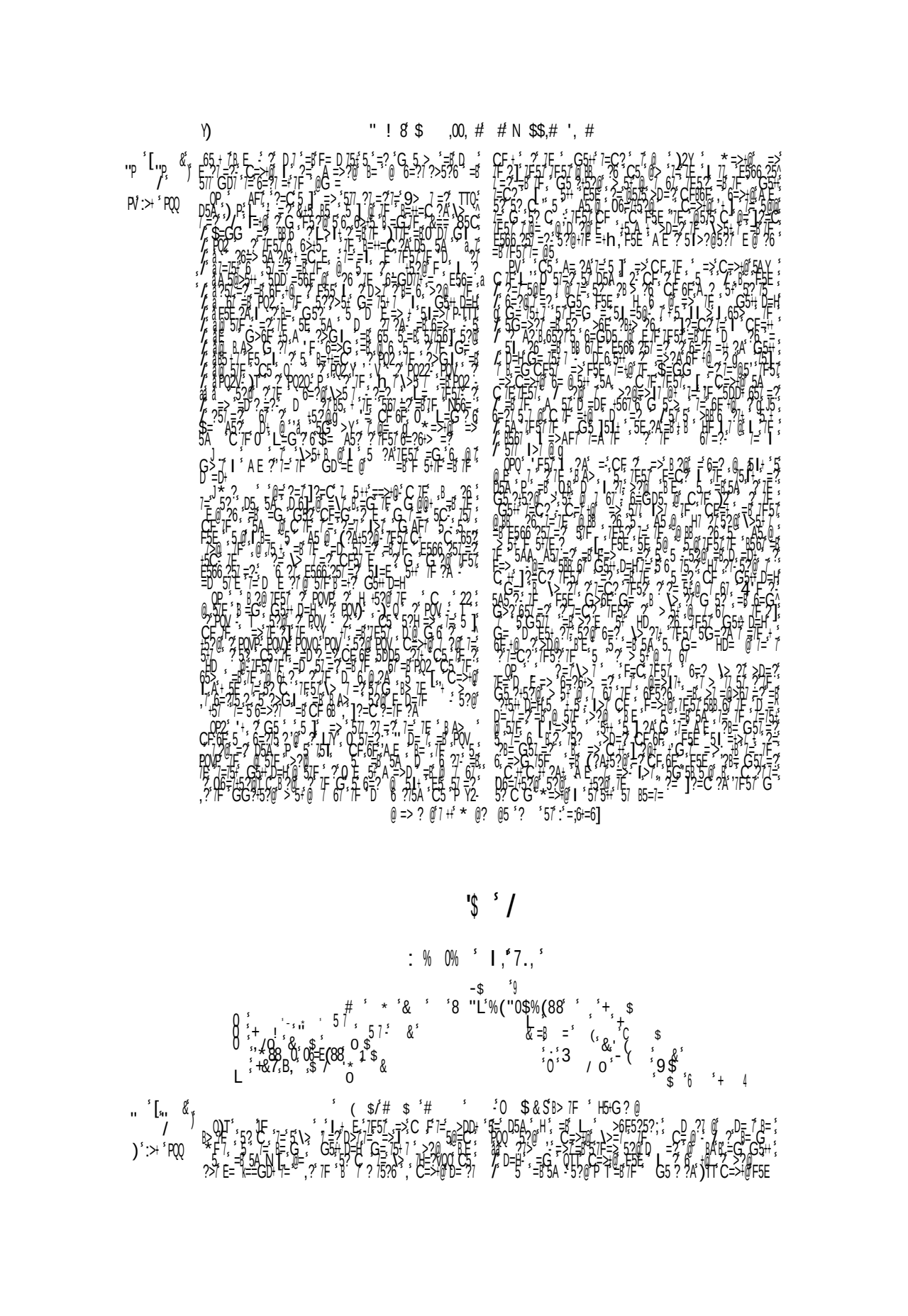

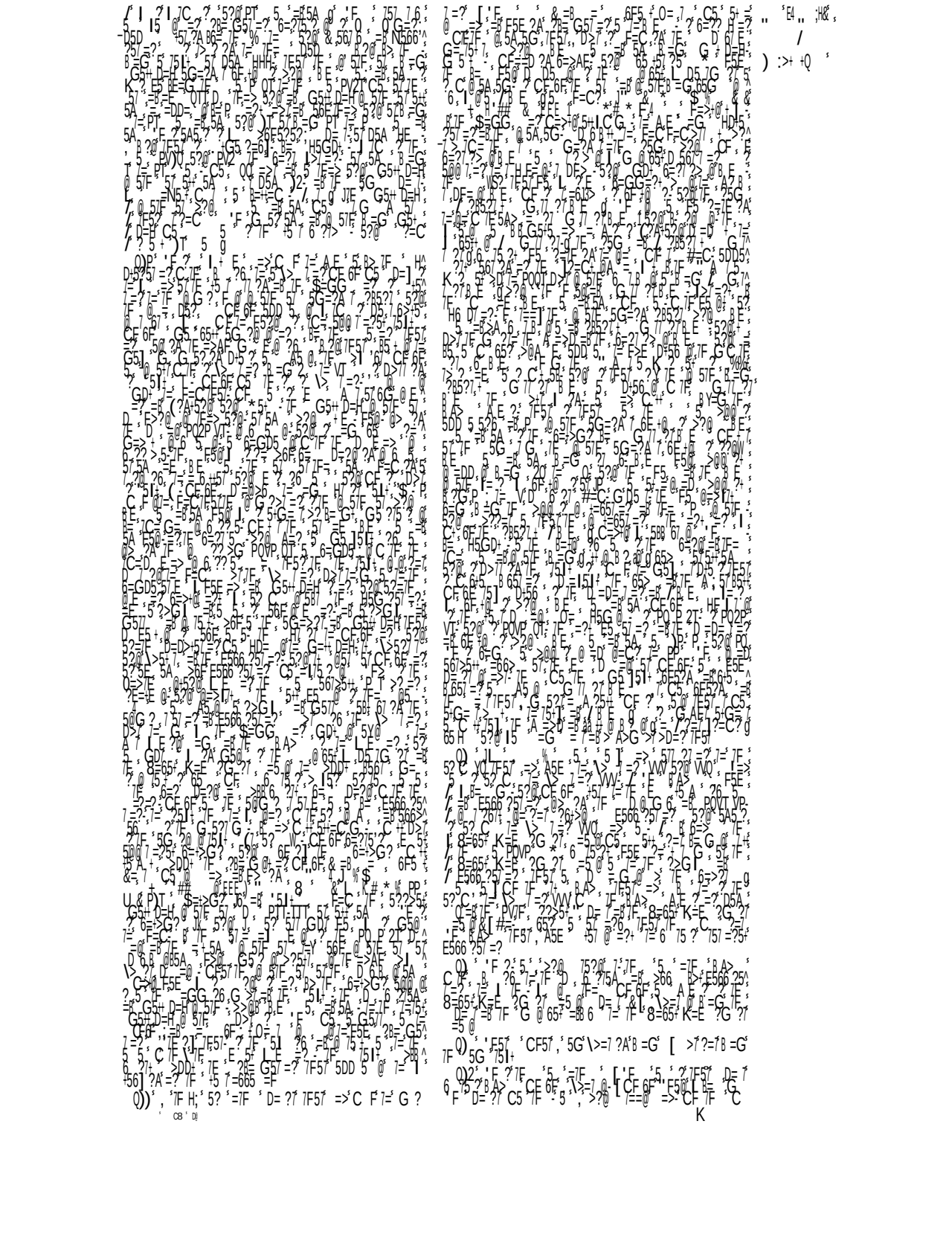

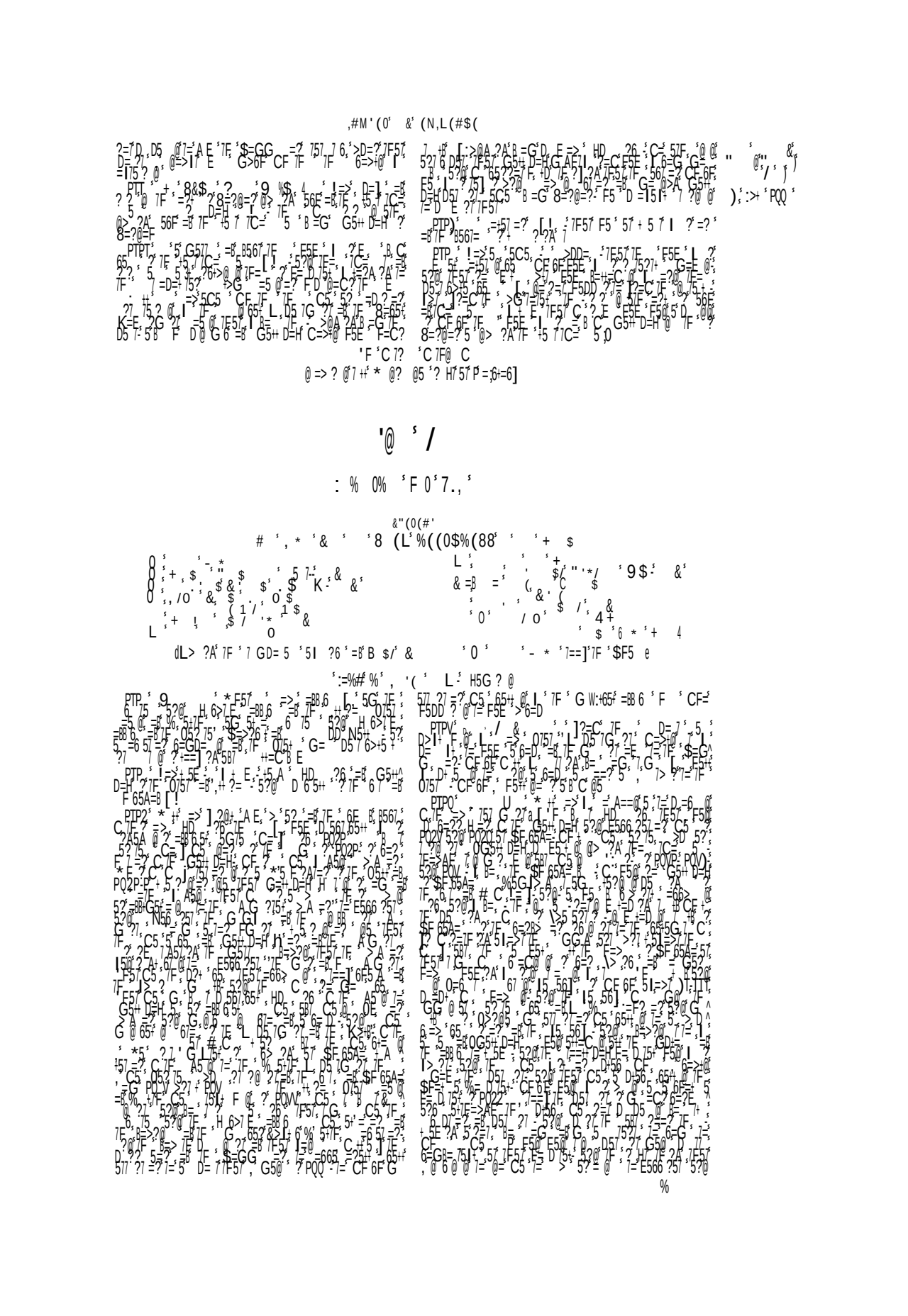

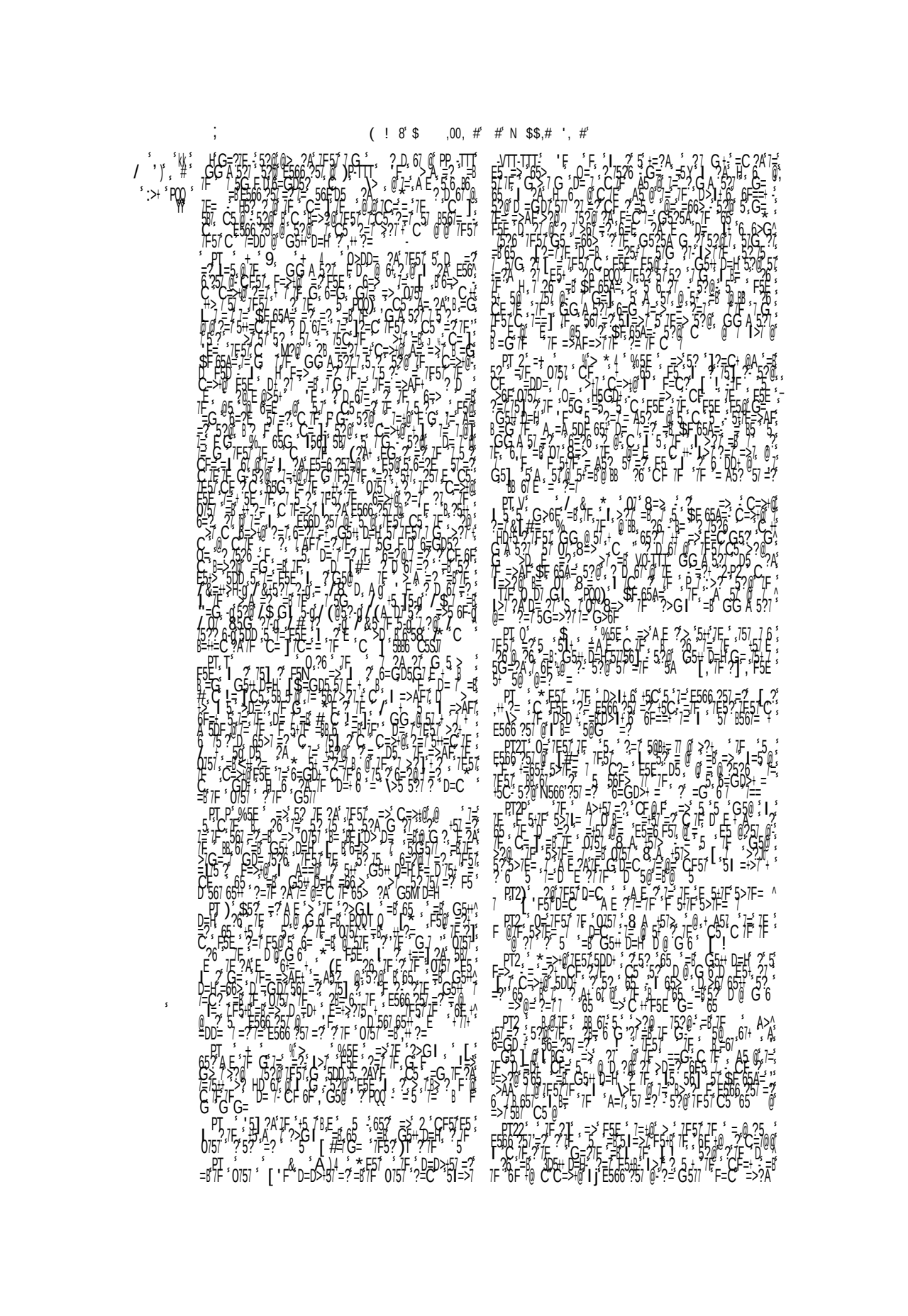

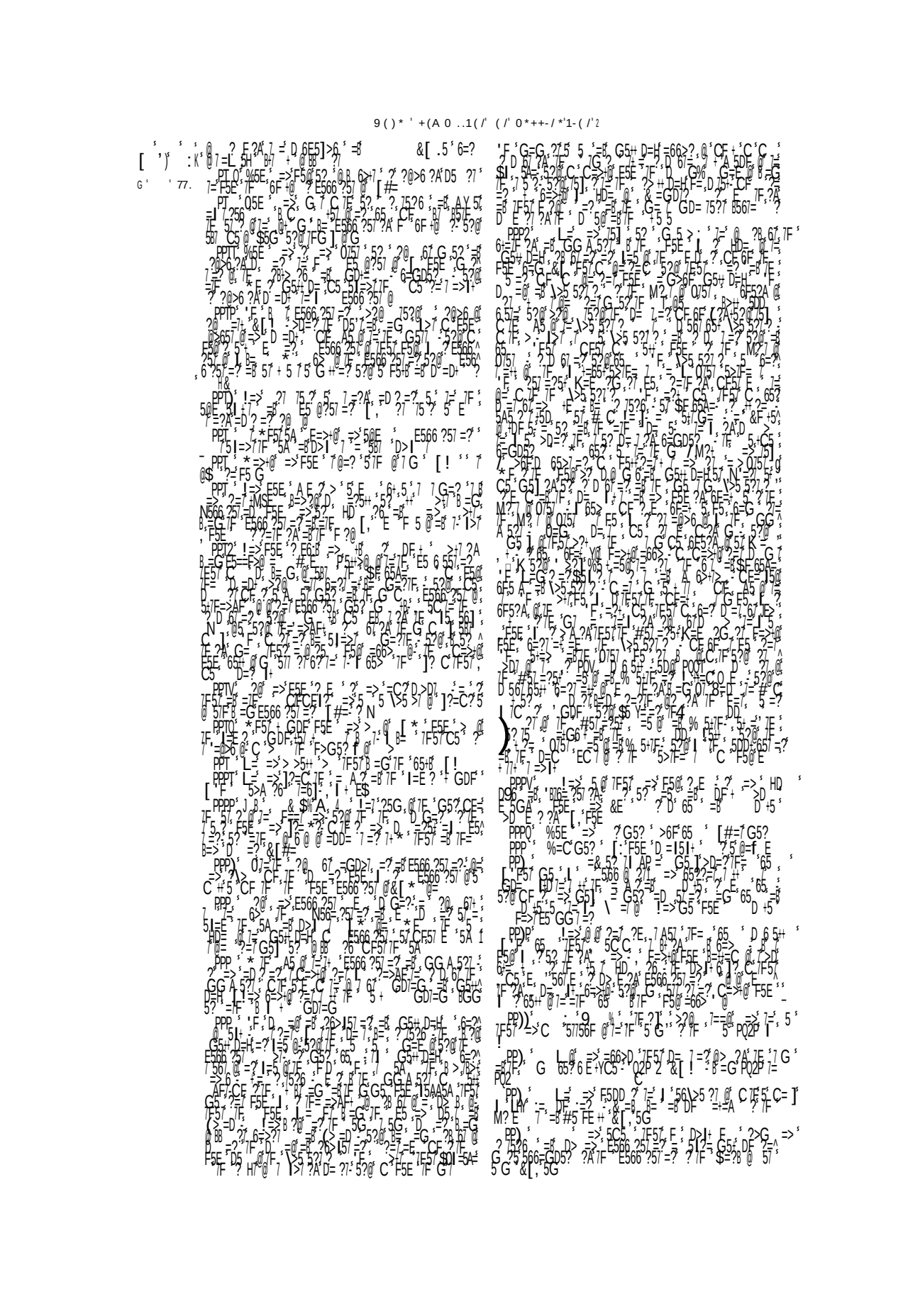

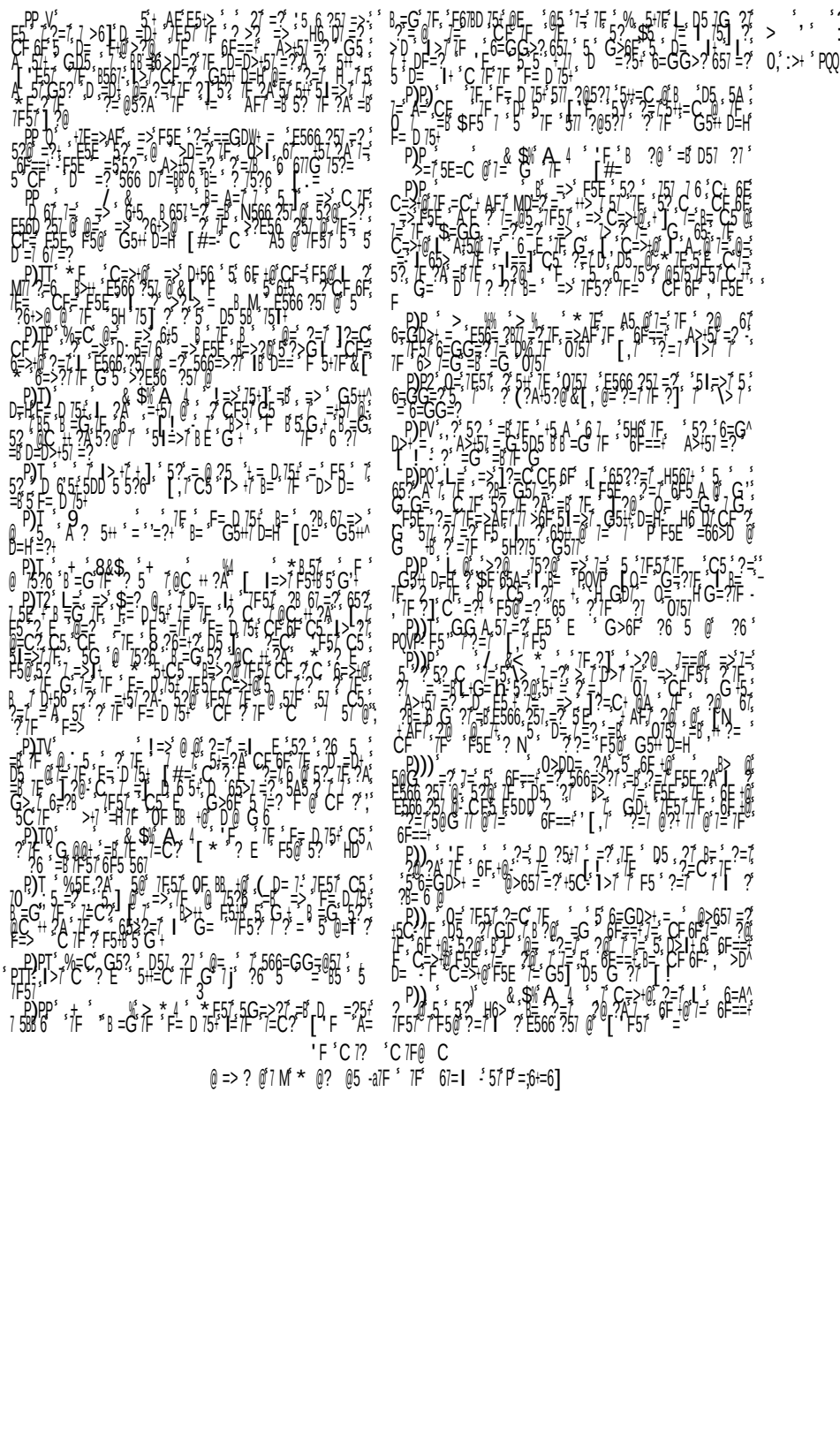

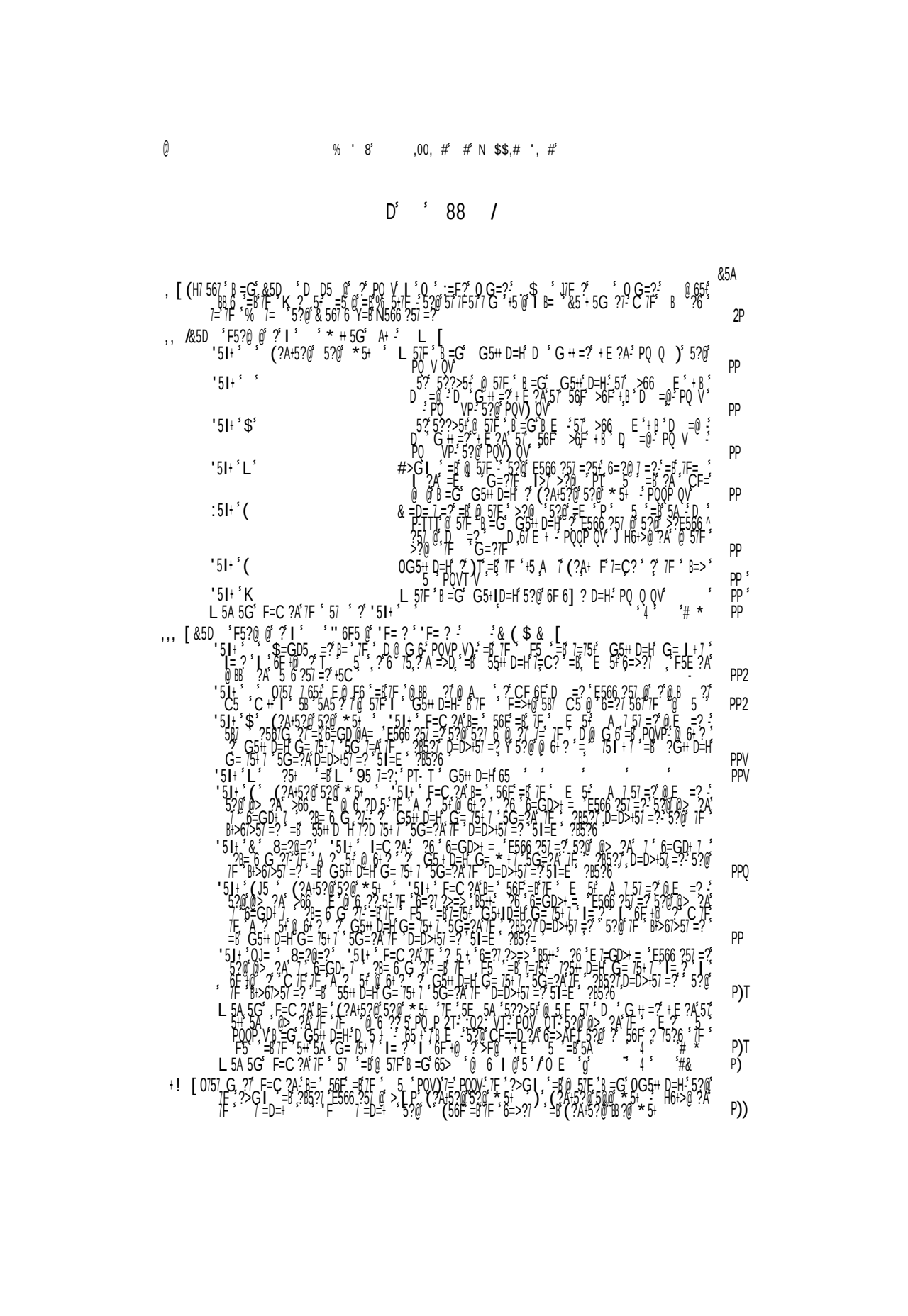

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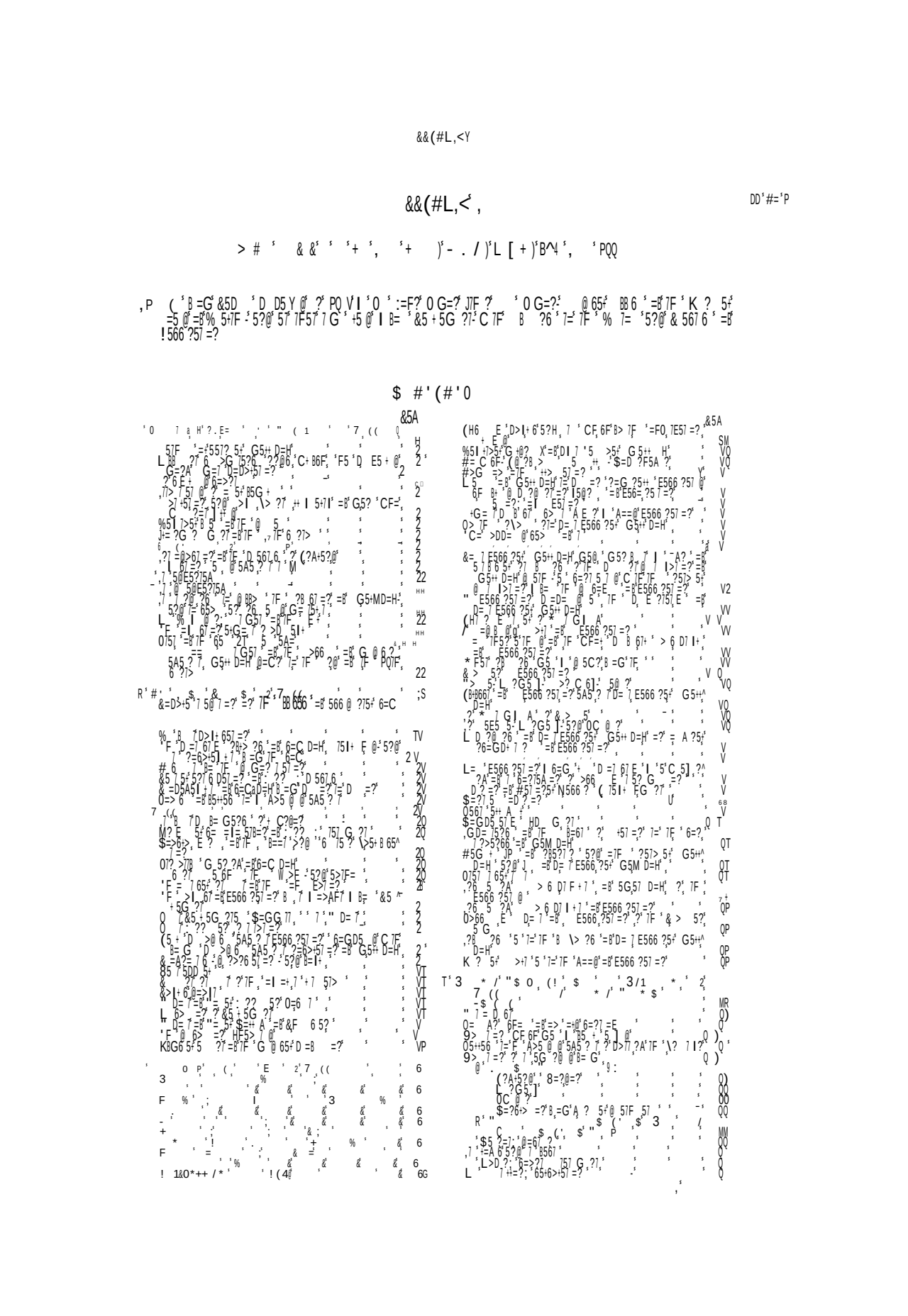

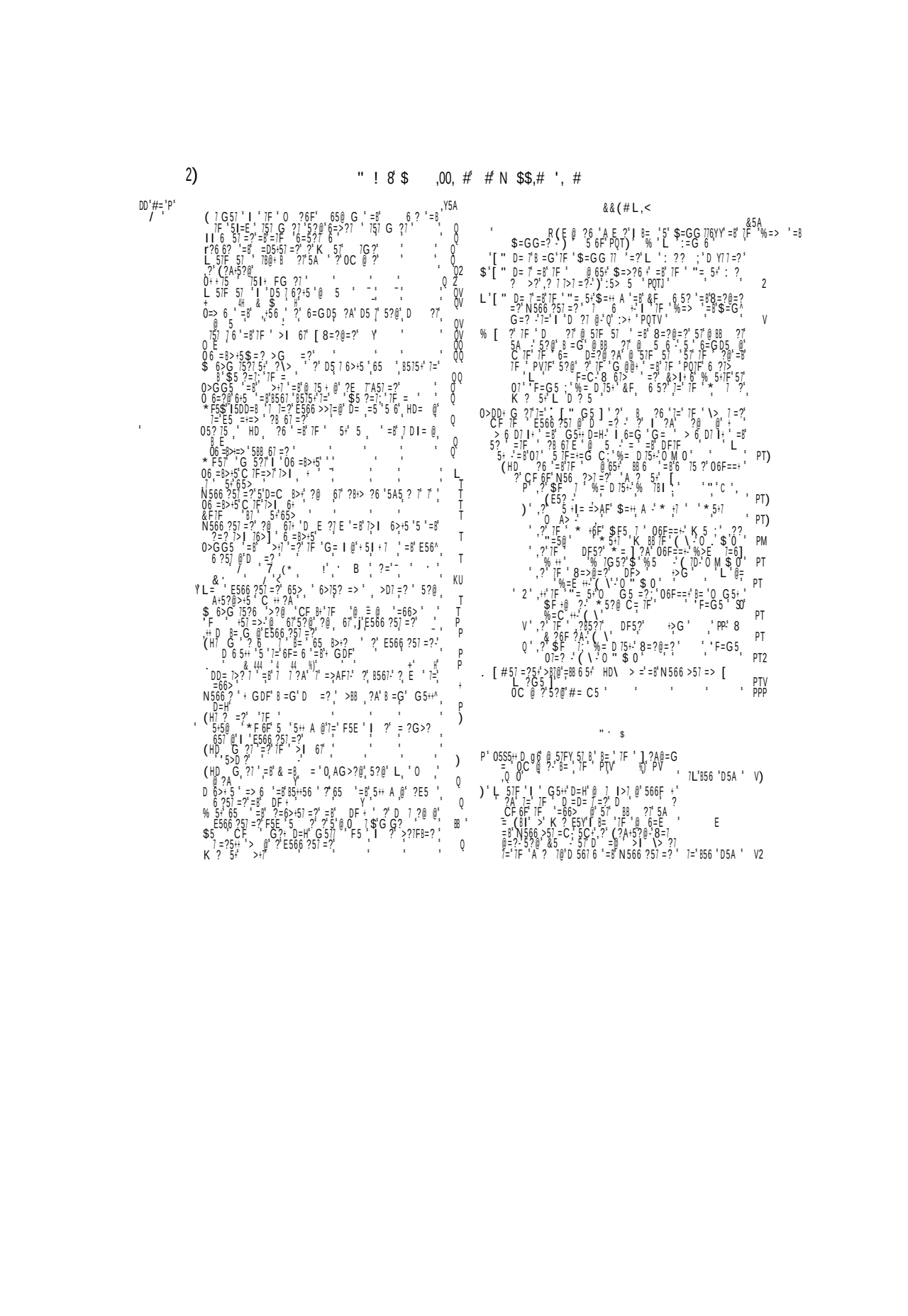

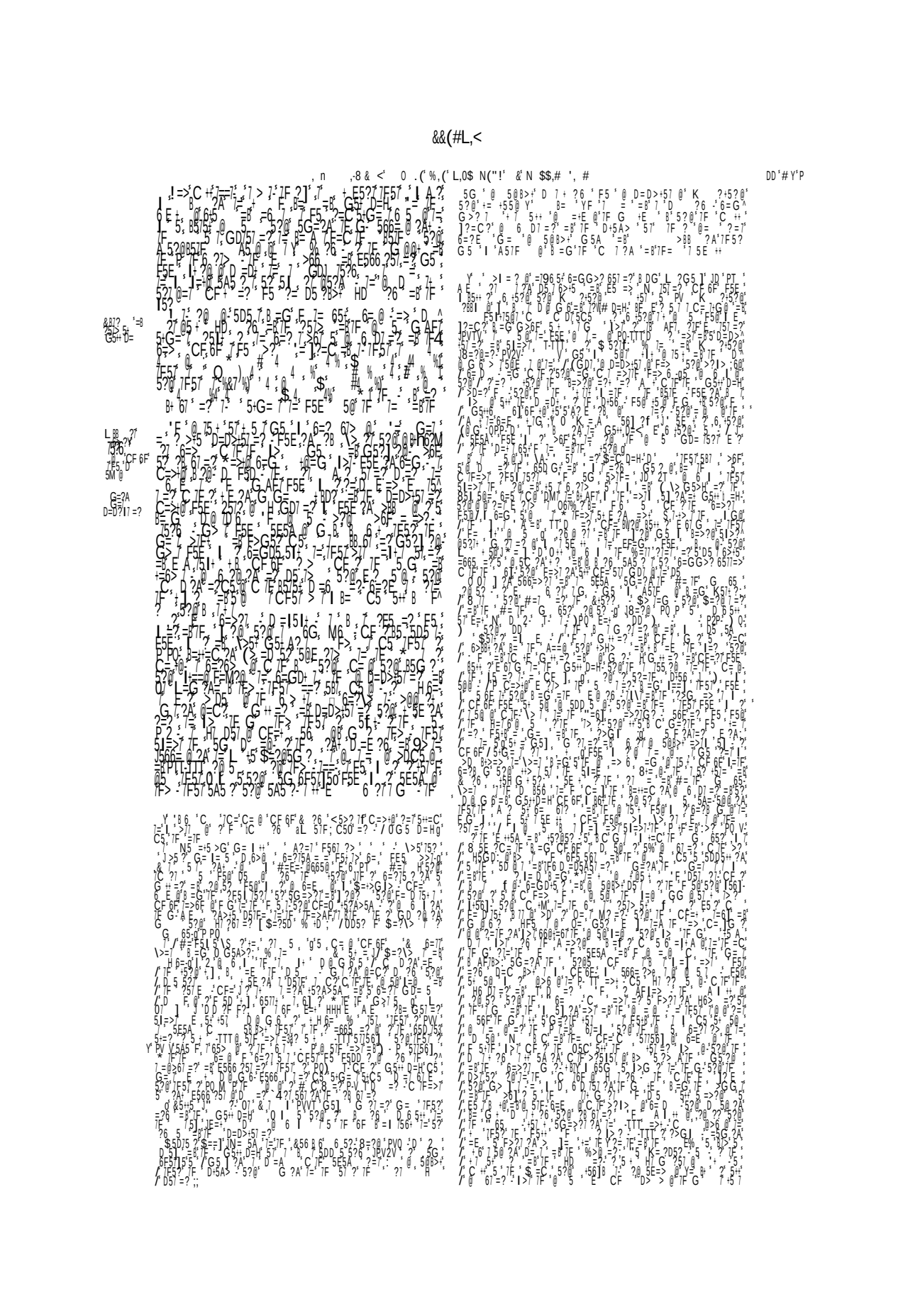

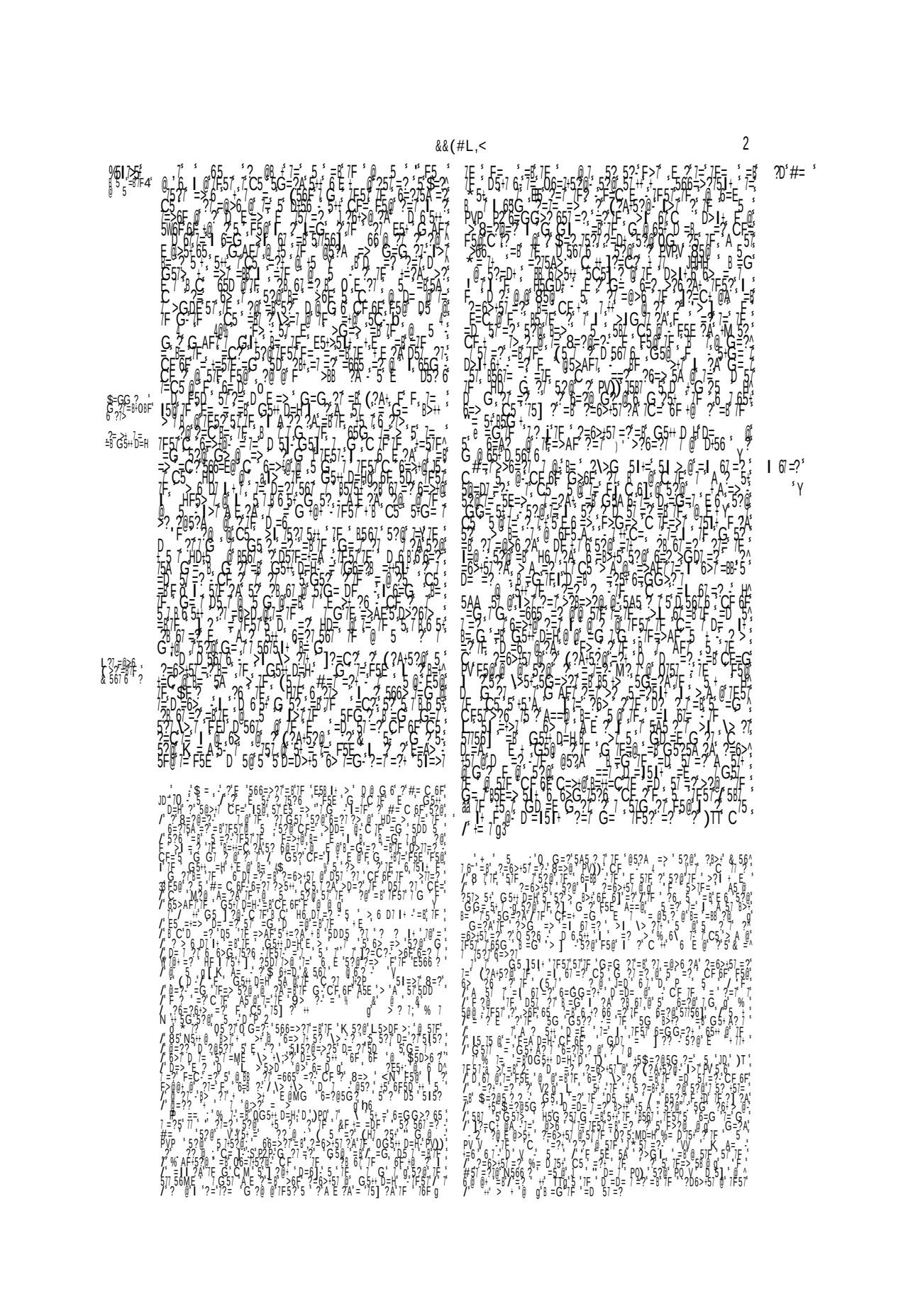

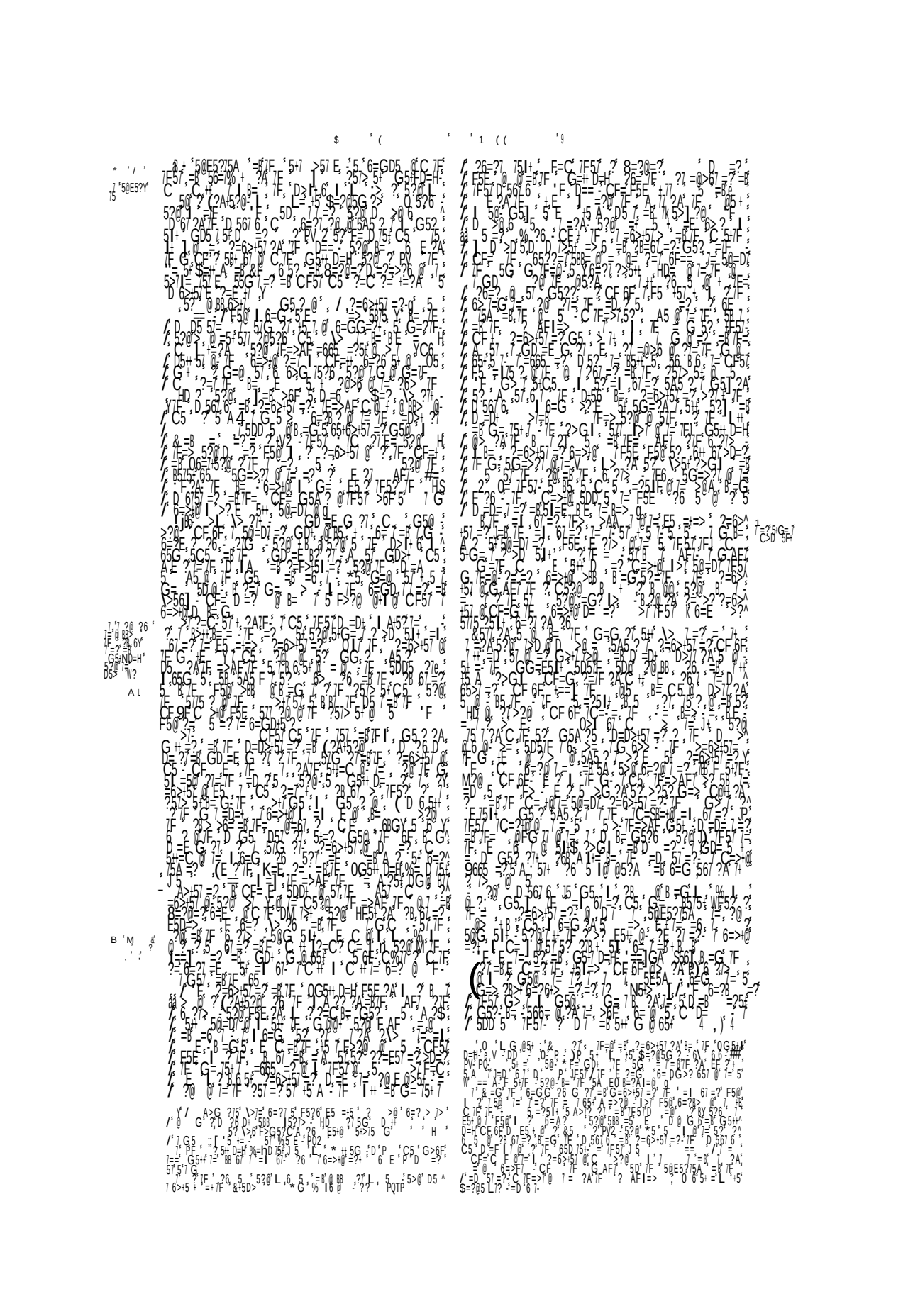

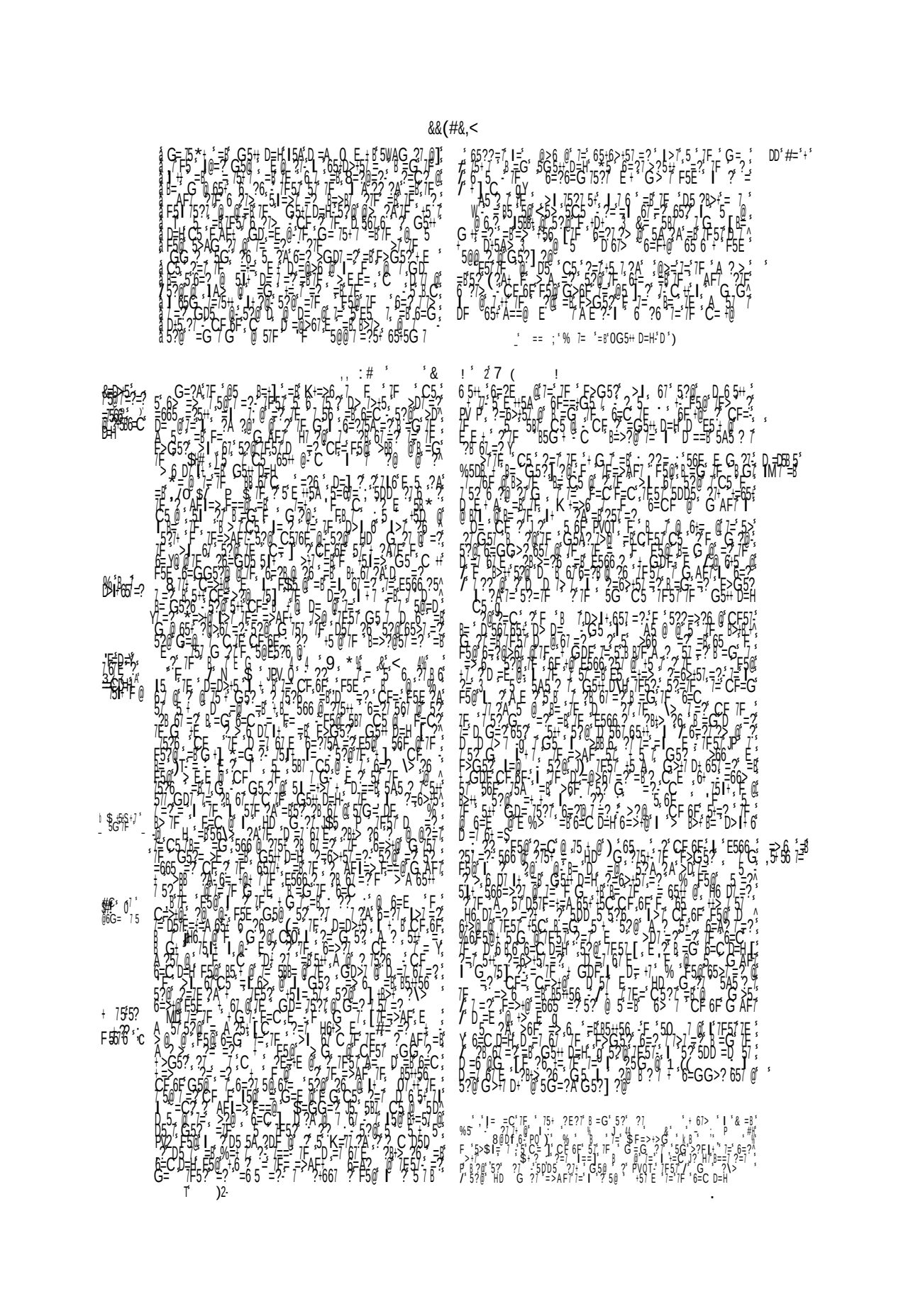

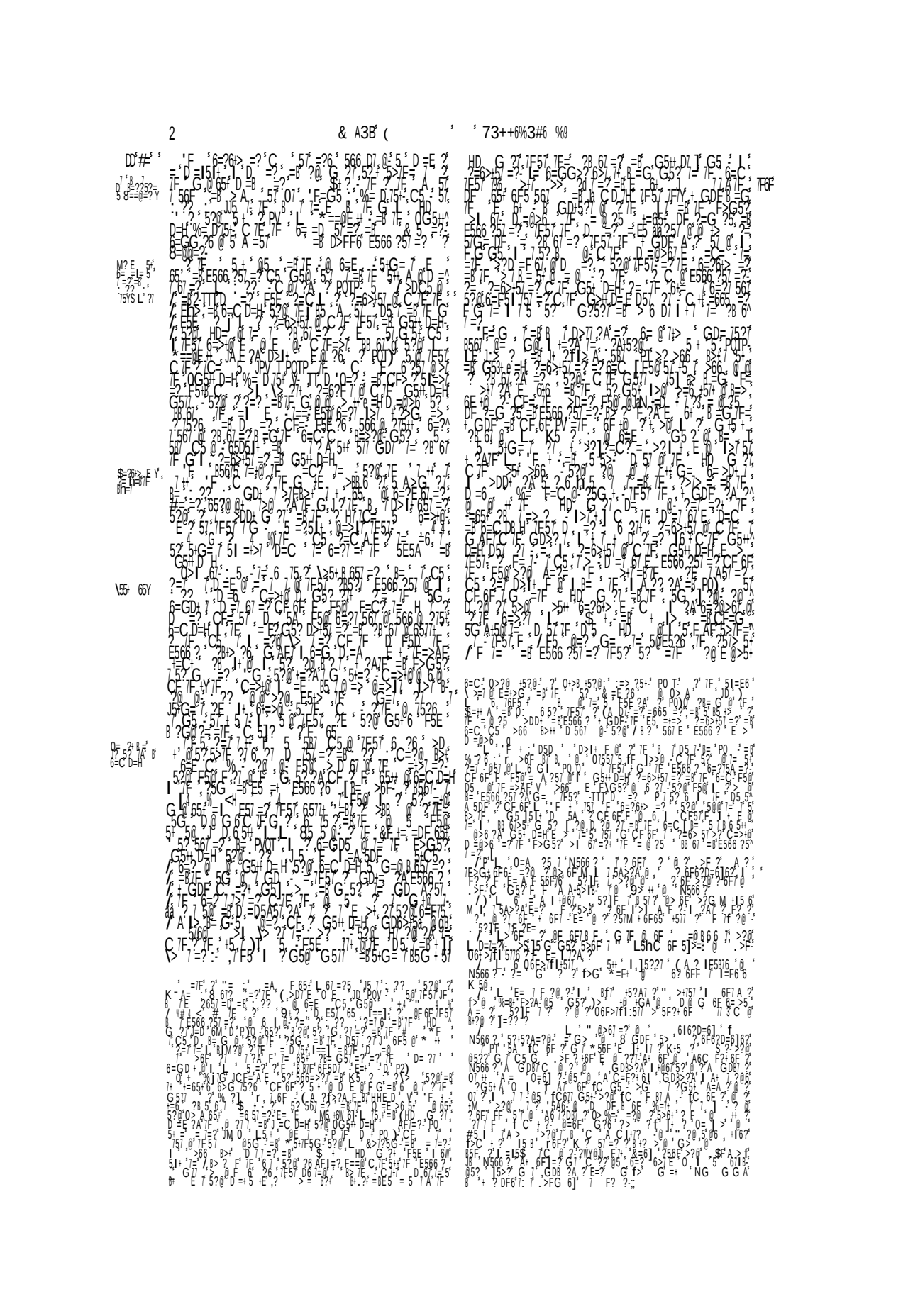

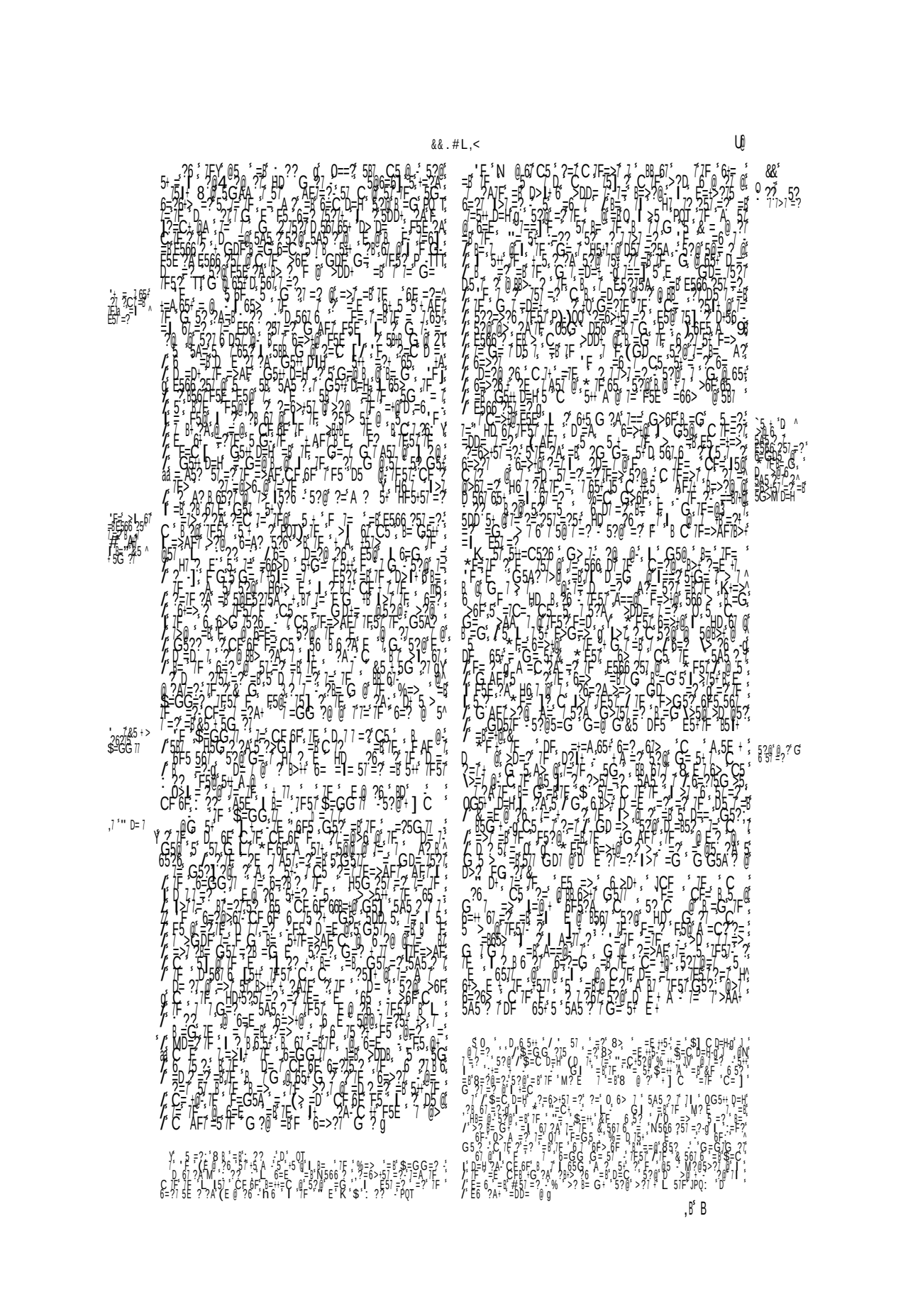

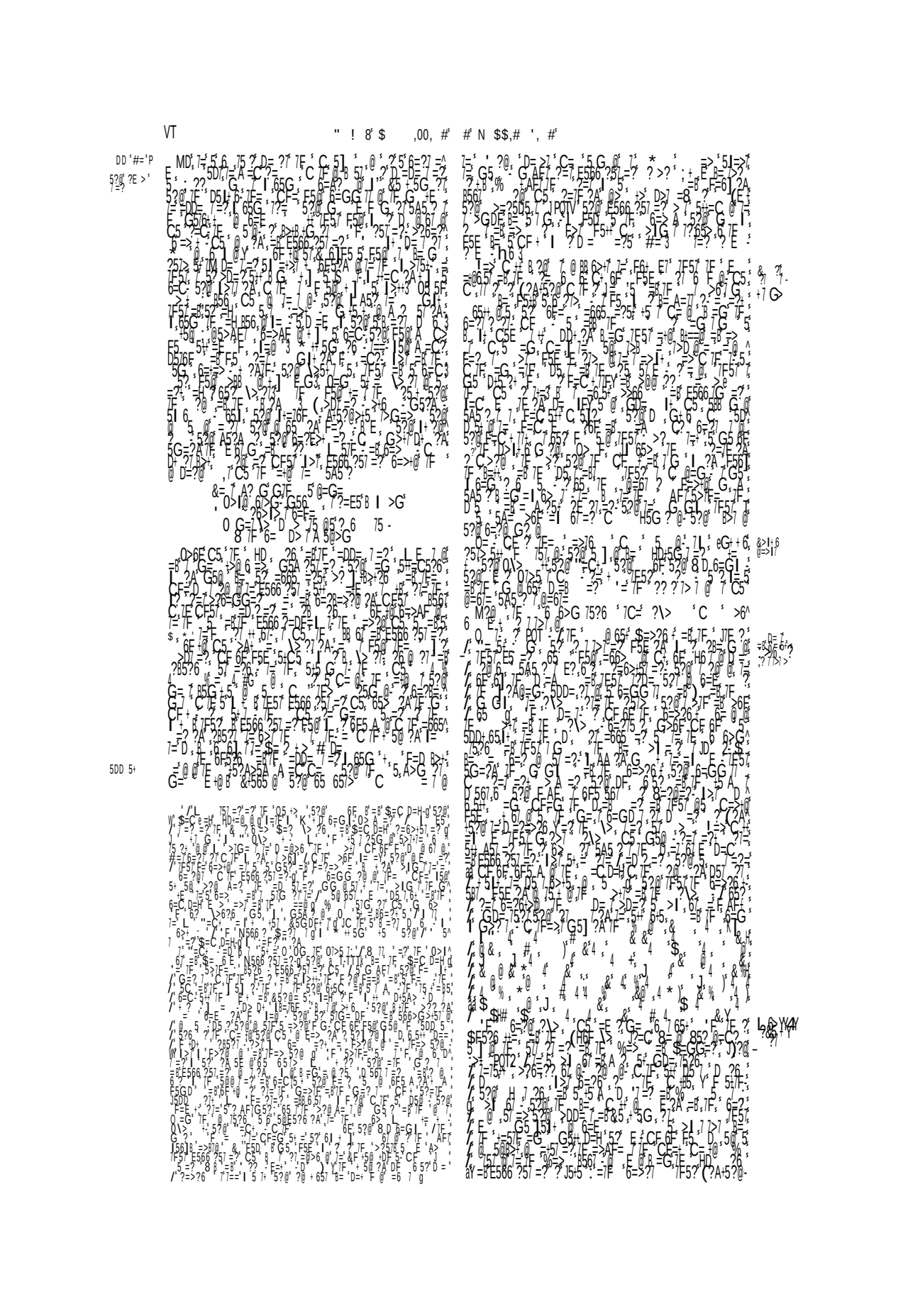

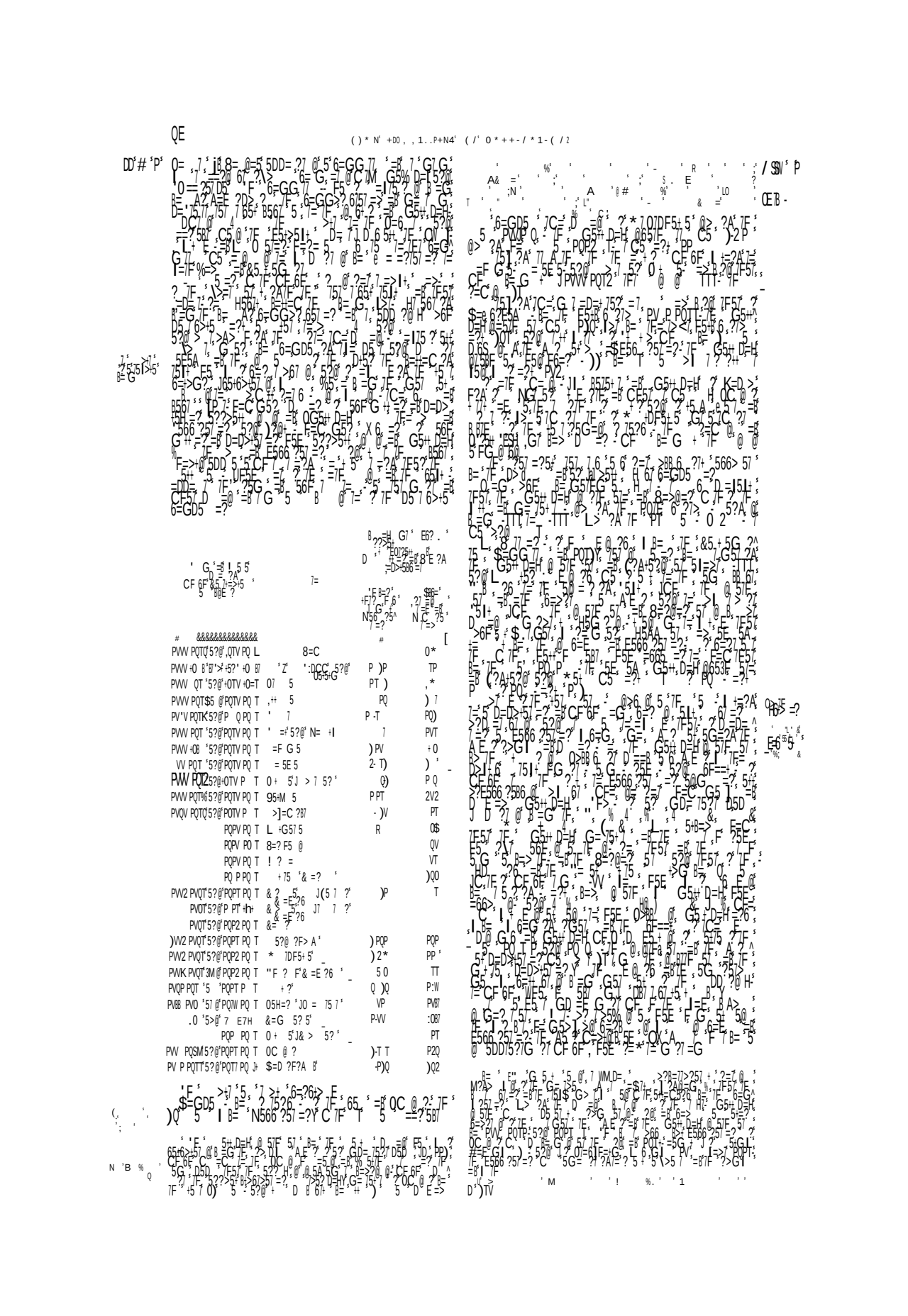

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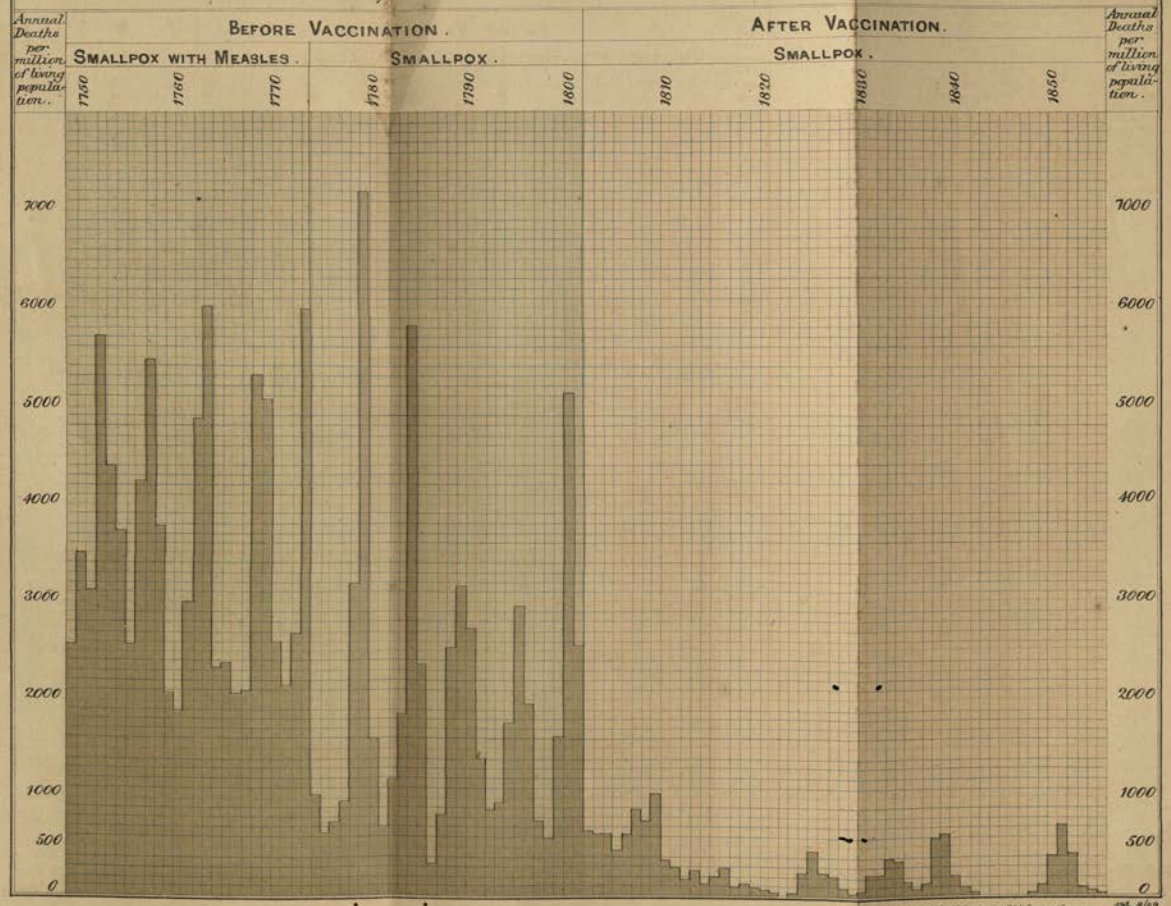
Smallpox Death Rates for the Kingdom of Sweden, for the 107 years 1749 1855.

Calculated by Mr. Haile from returns communicated by the Swedish Government.



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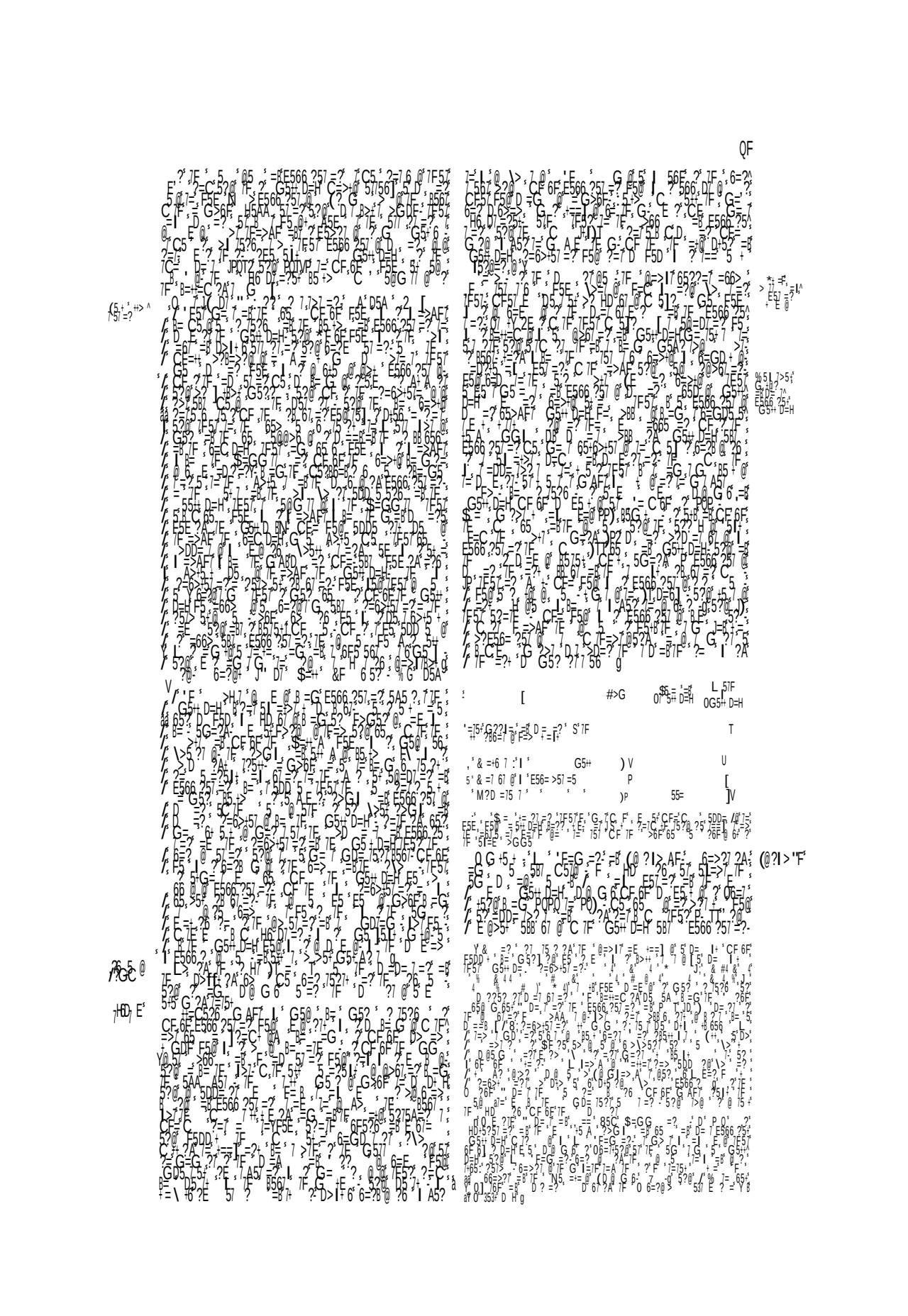

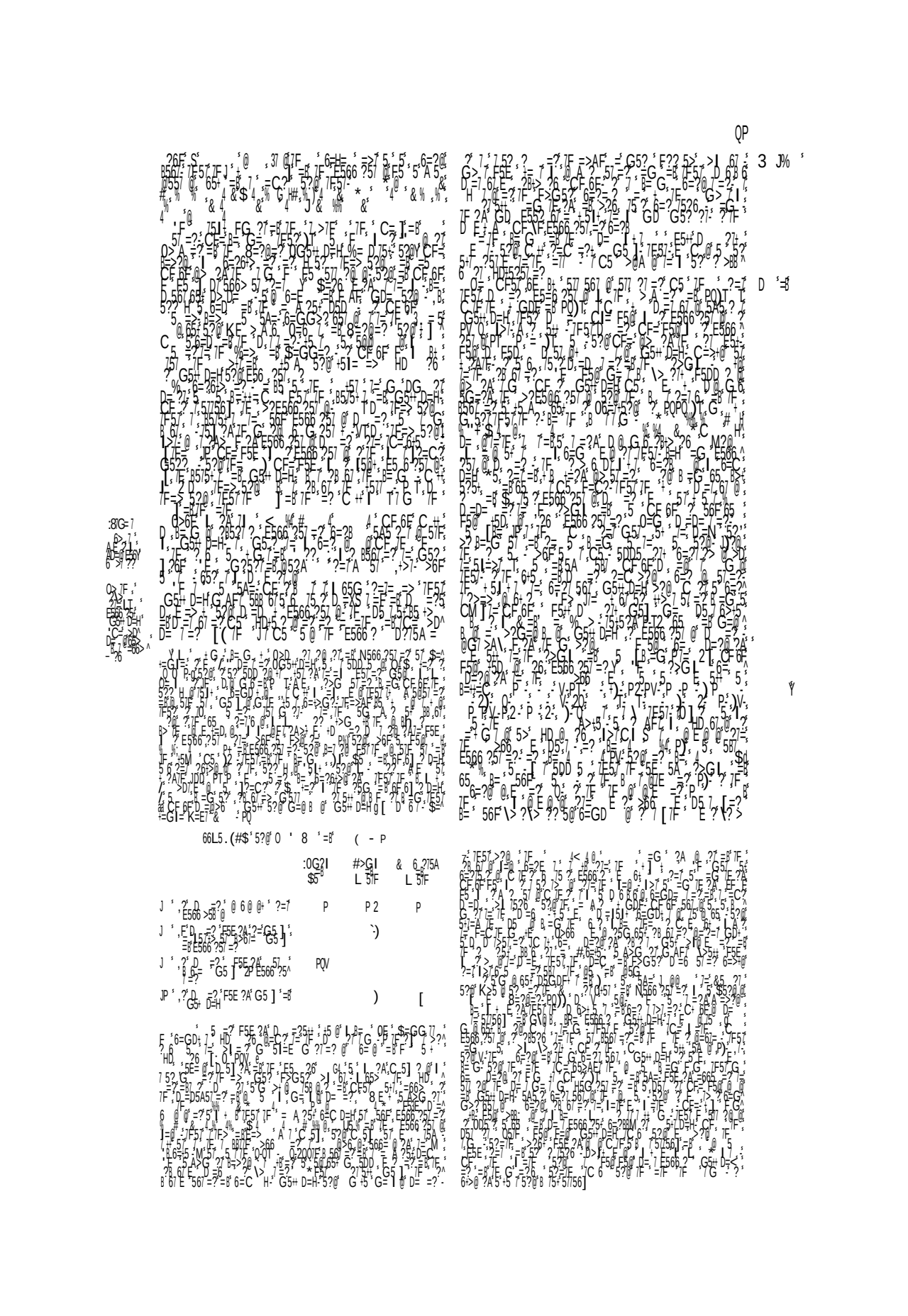

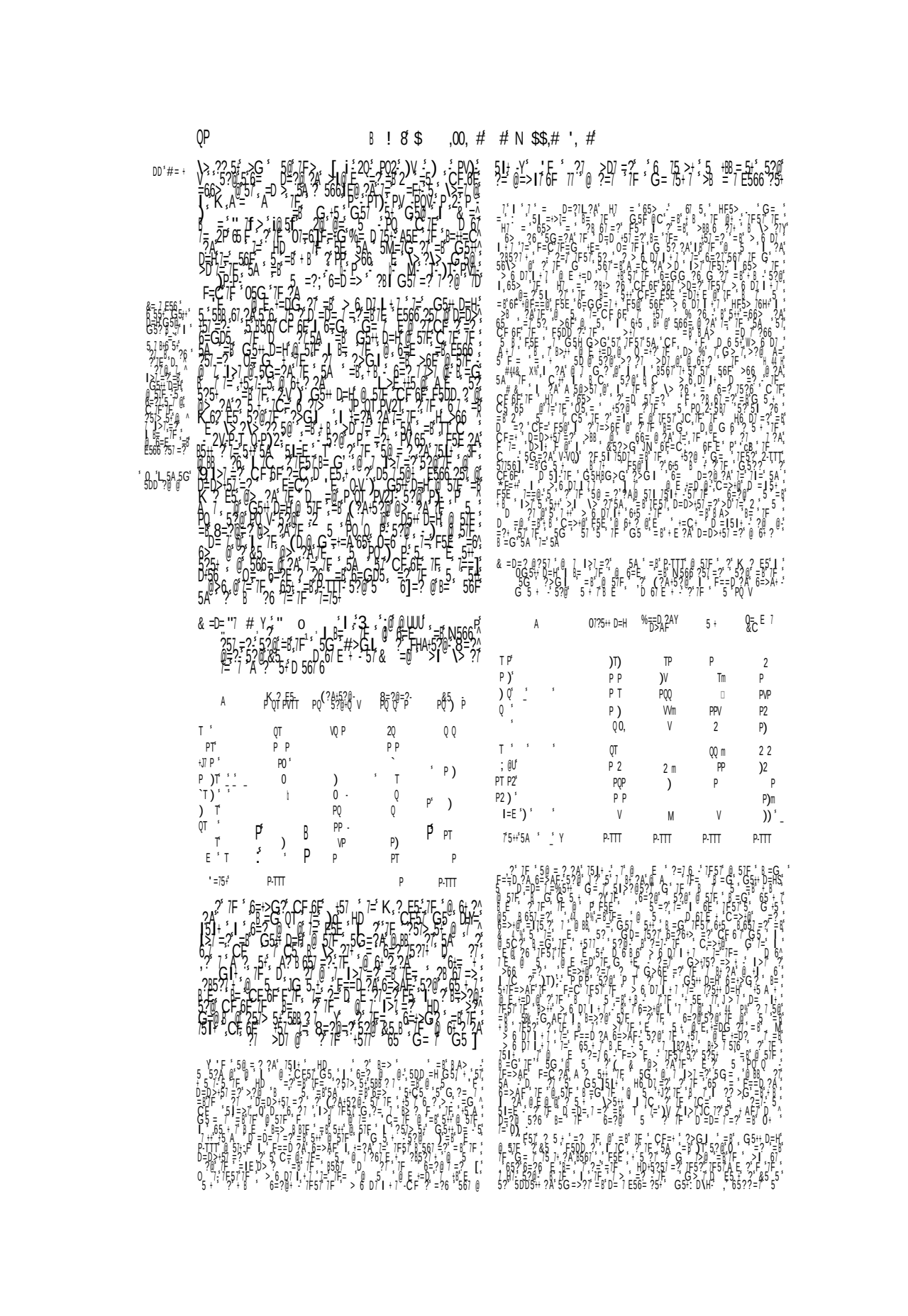

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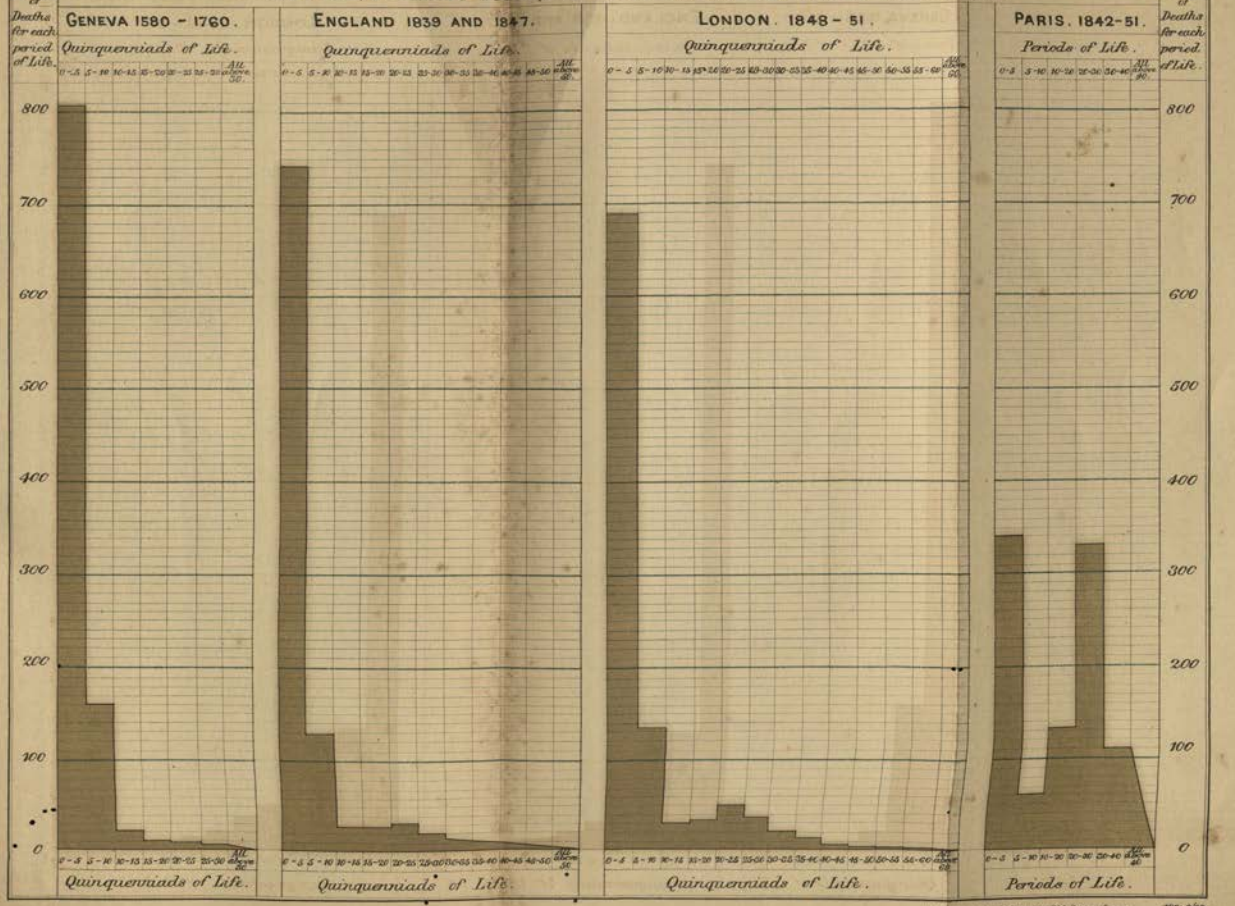
DEATHS BY SMALLPOX DISTRIBUTED ACCORDING TO THE PROPORTION PER 1,000 IN WHICH THEY OCCURRED AT DIFFERENT AGES OF LIFE IN GENEVA, BEFORE THE DISCOVERY OF VACCINATION, AND IN ENGLAND, LONDON AND PARIS, AT PERIODS SUBSEQUENT TO THE GENERAL PRACTICE OF VACCINATION.



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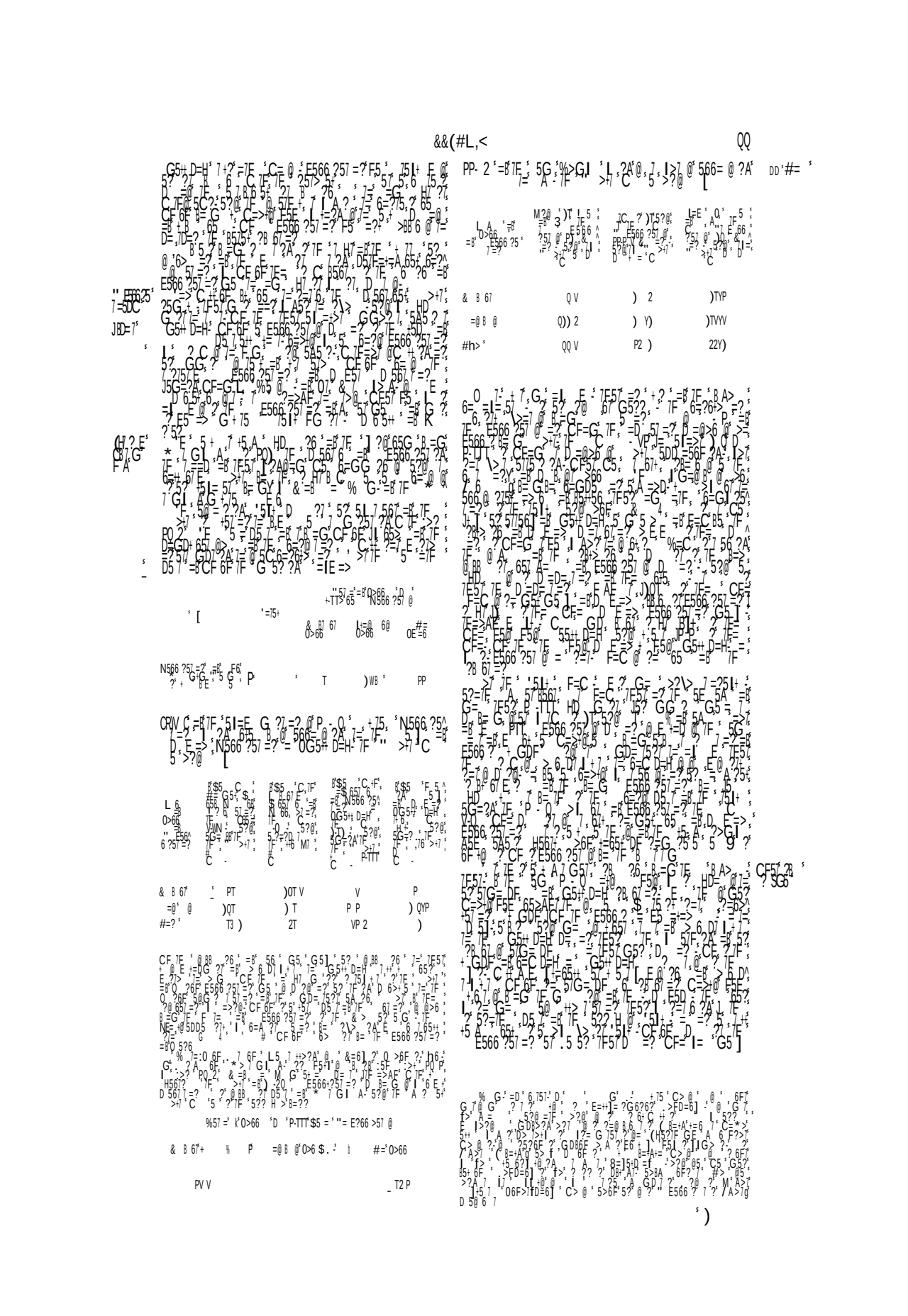

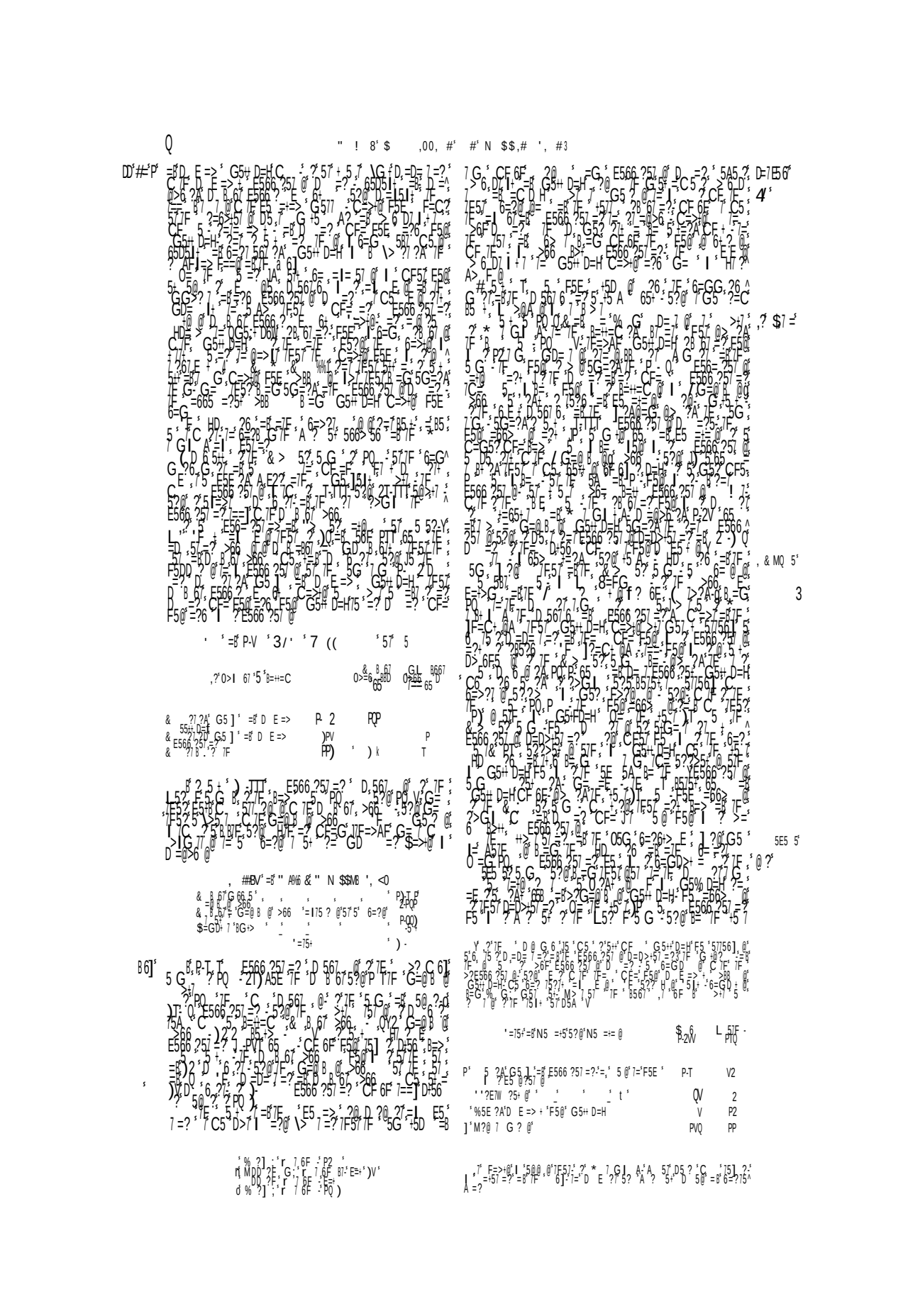

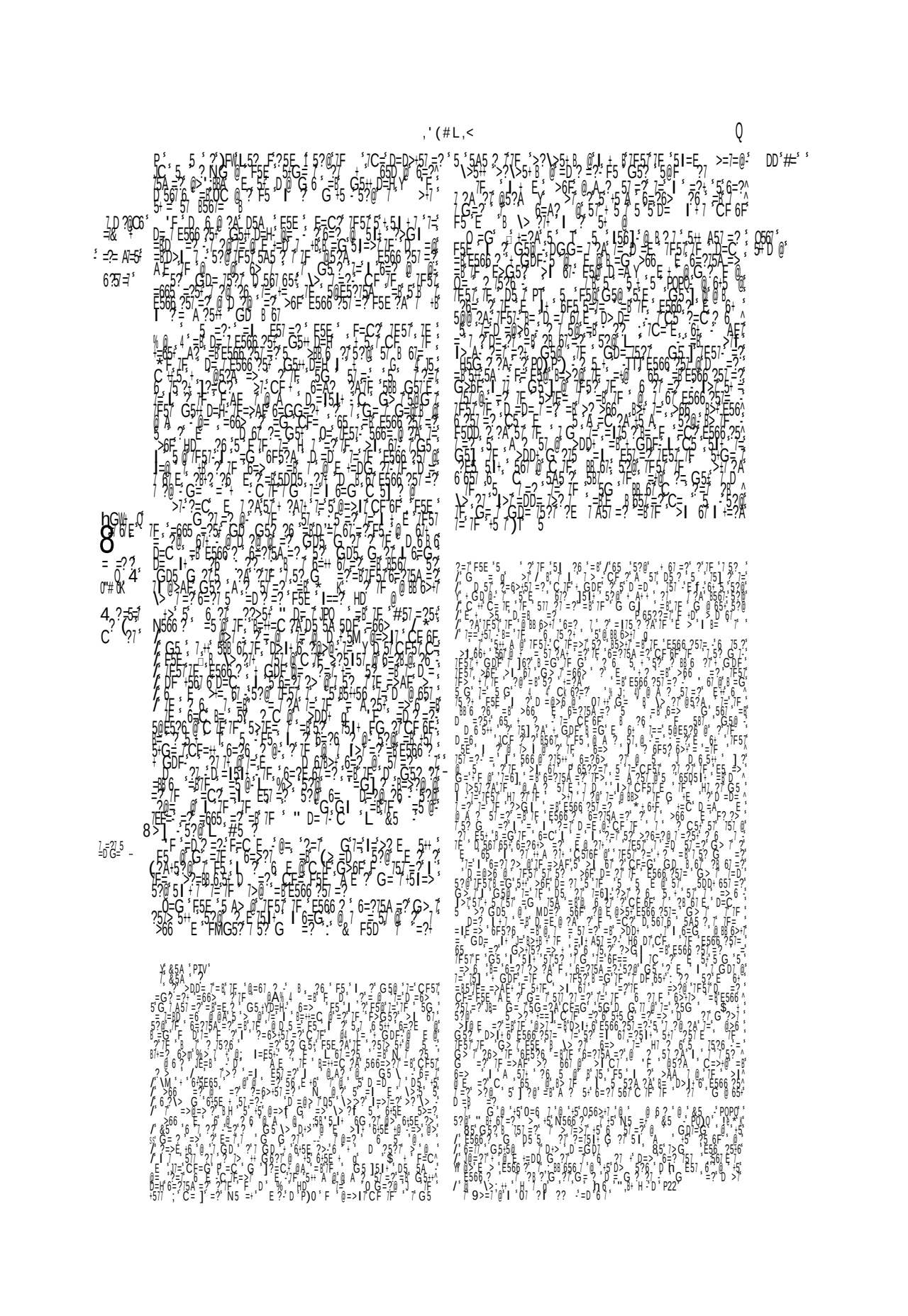

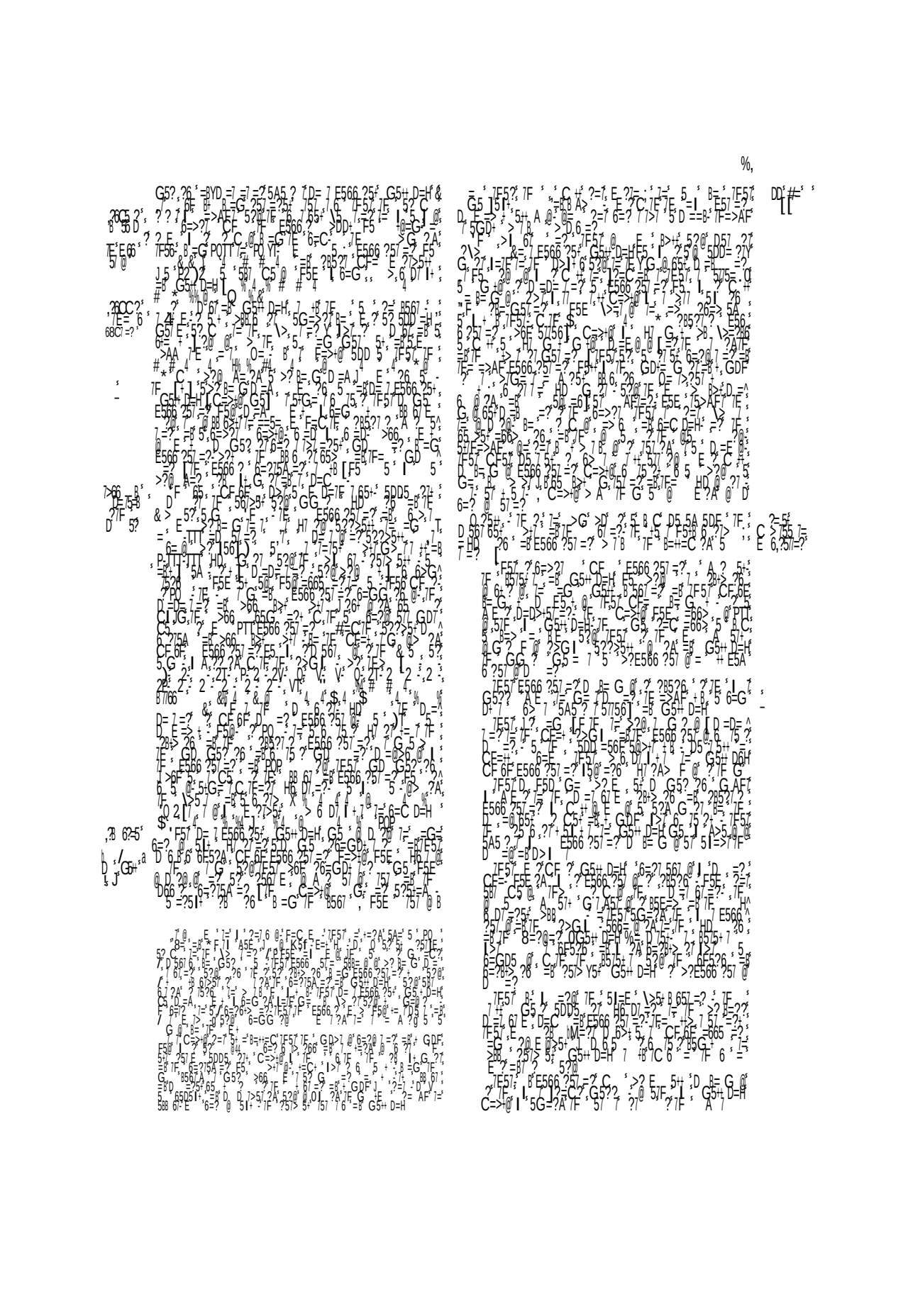

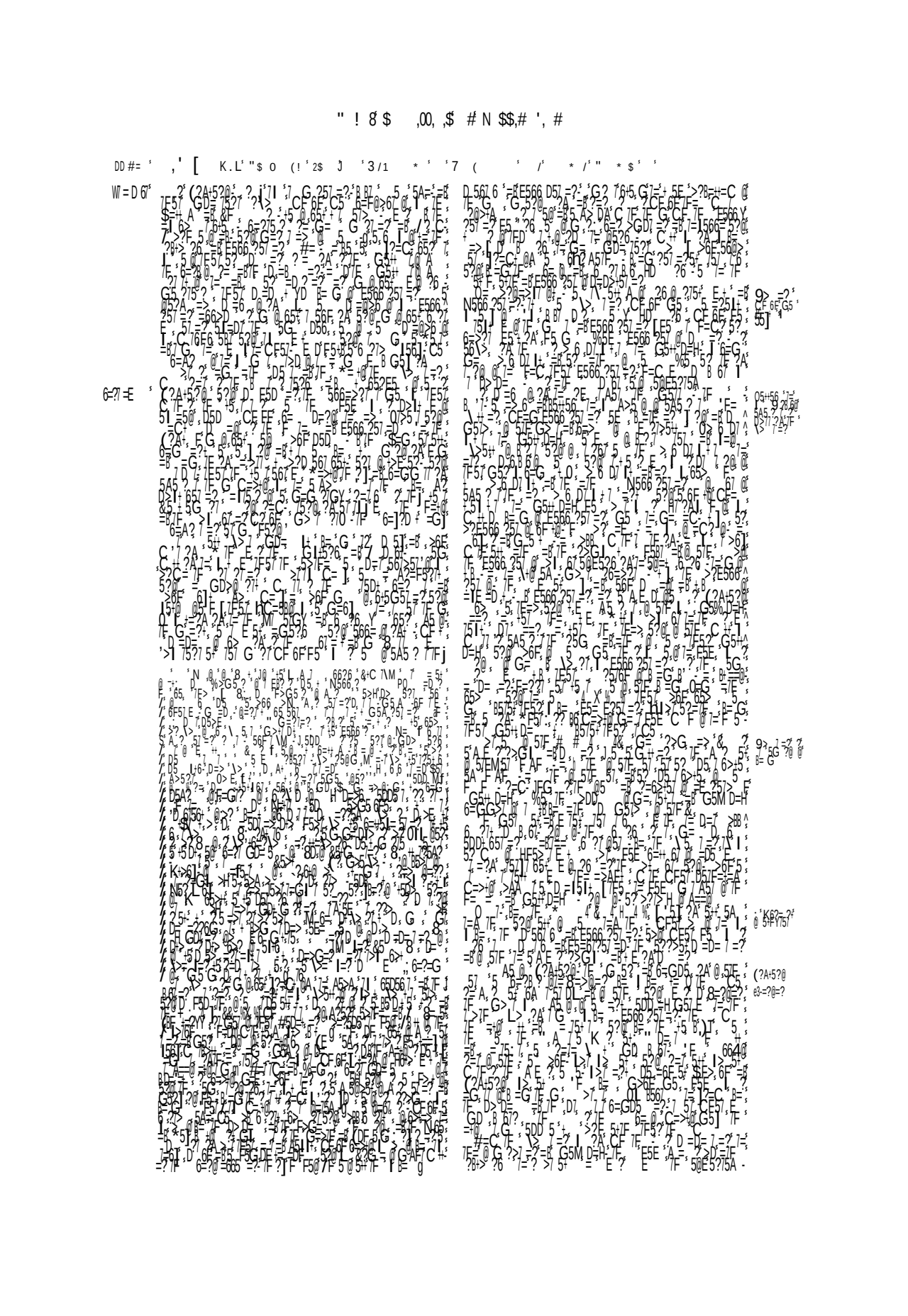

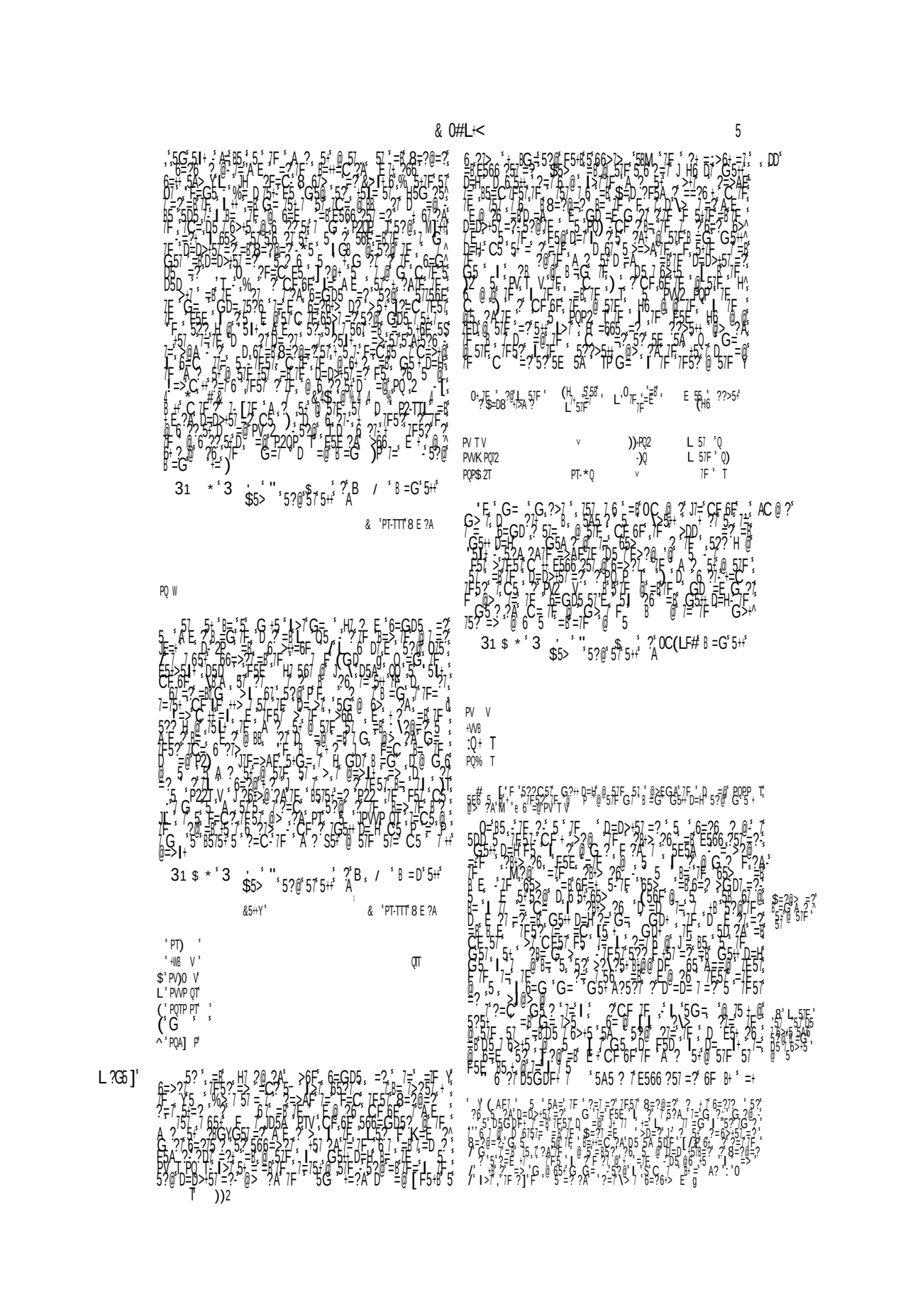

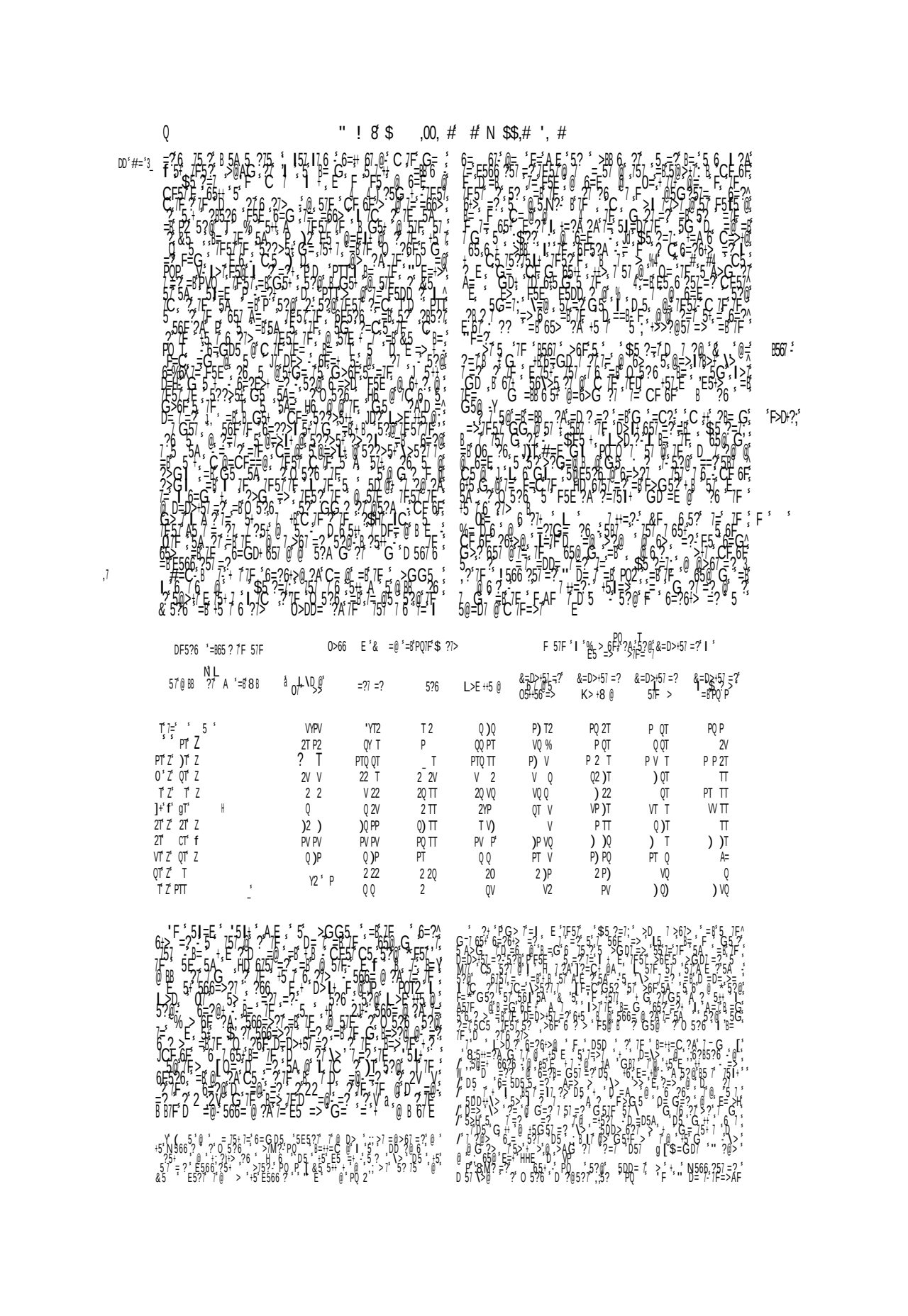

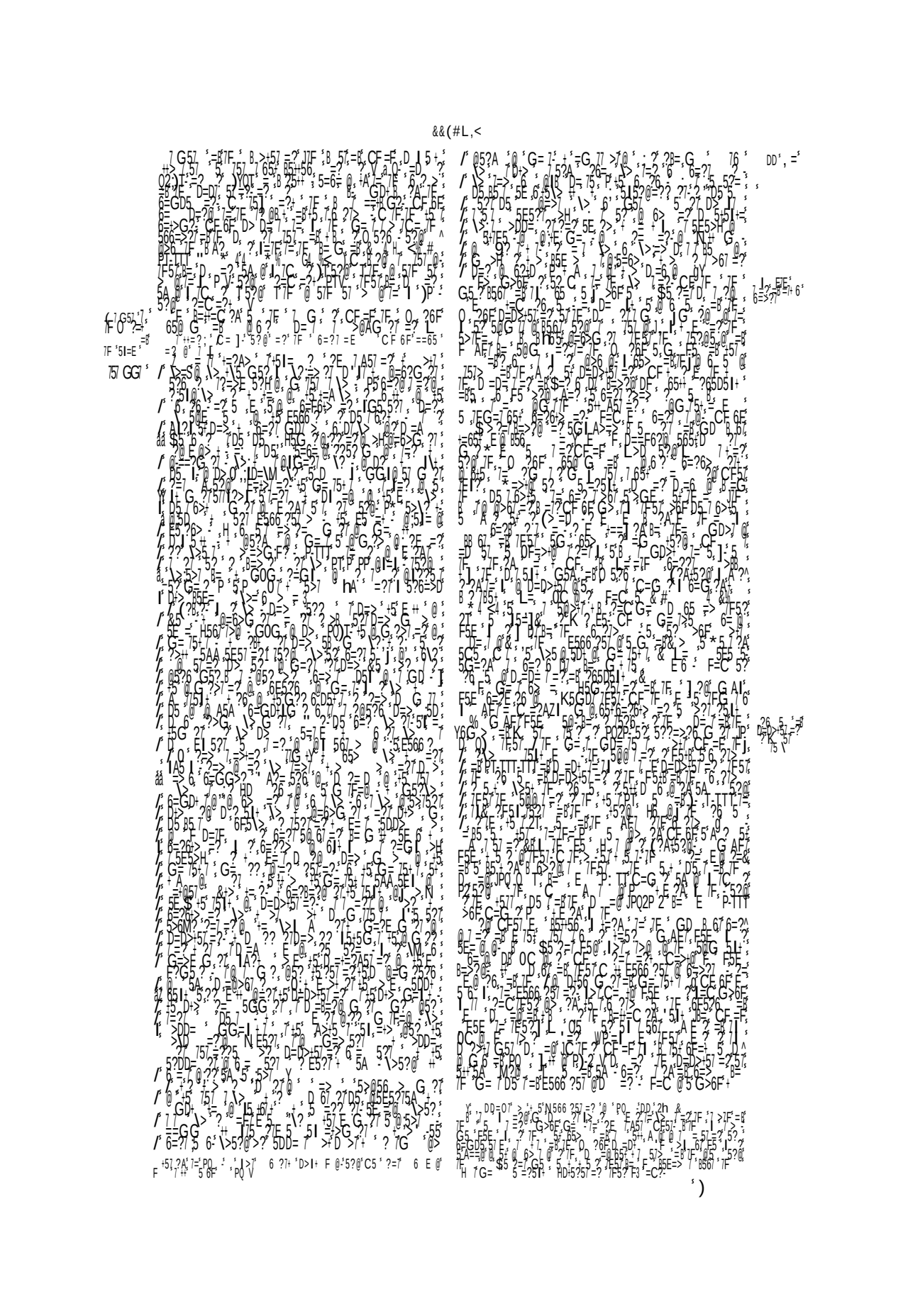

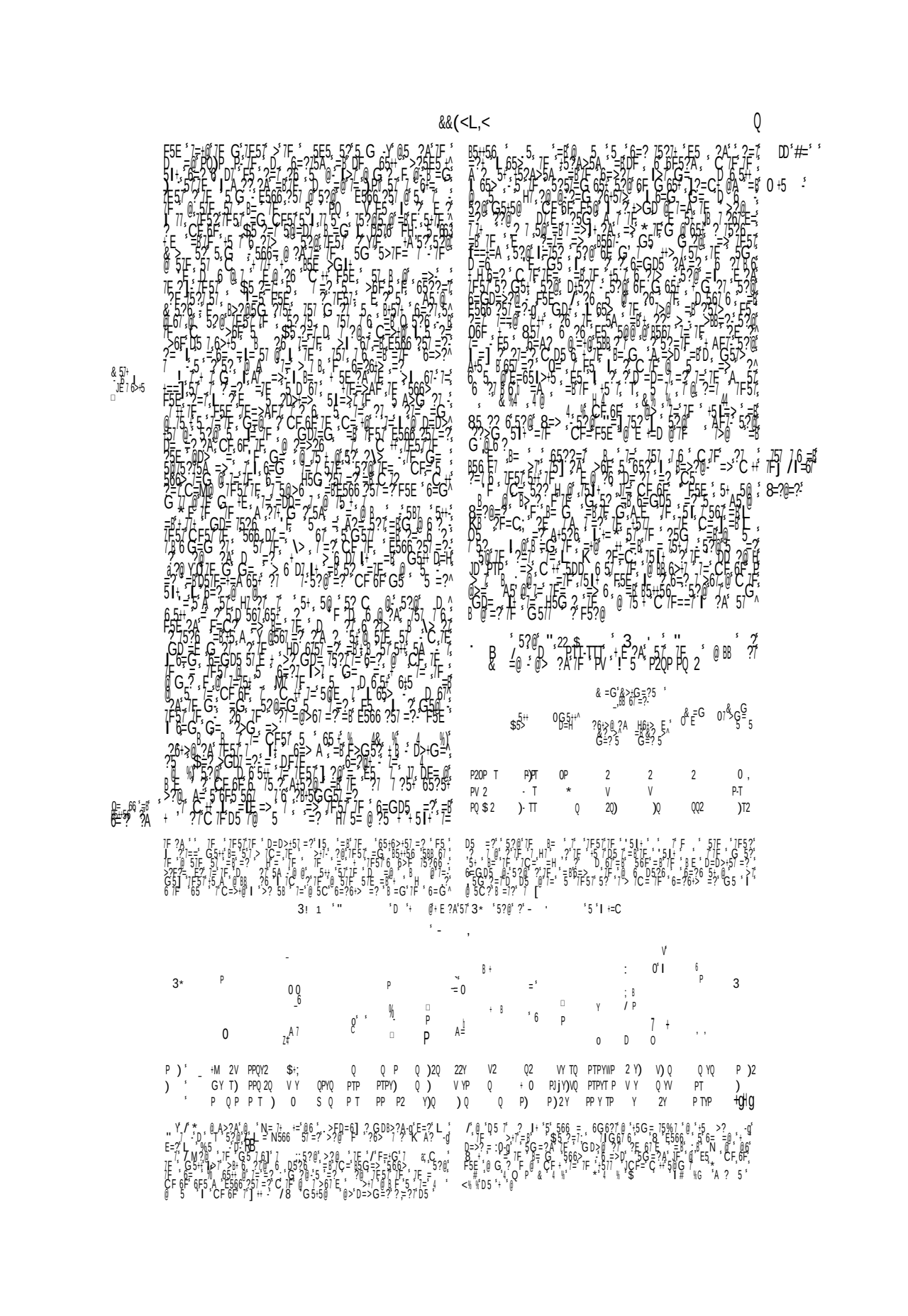

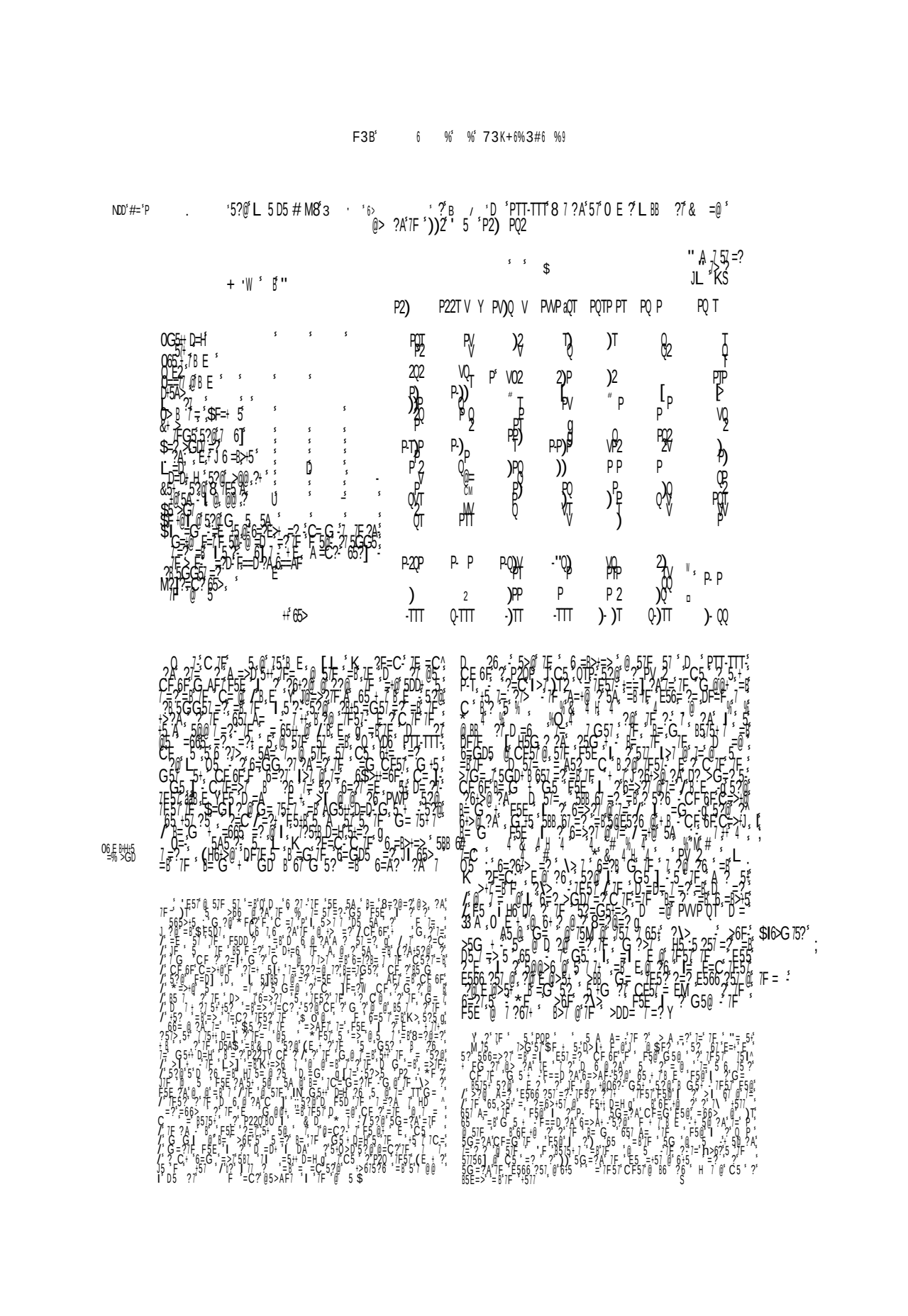

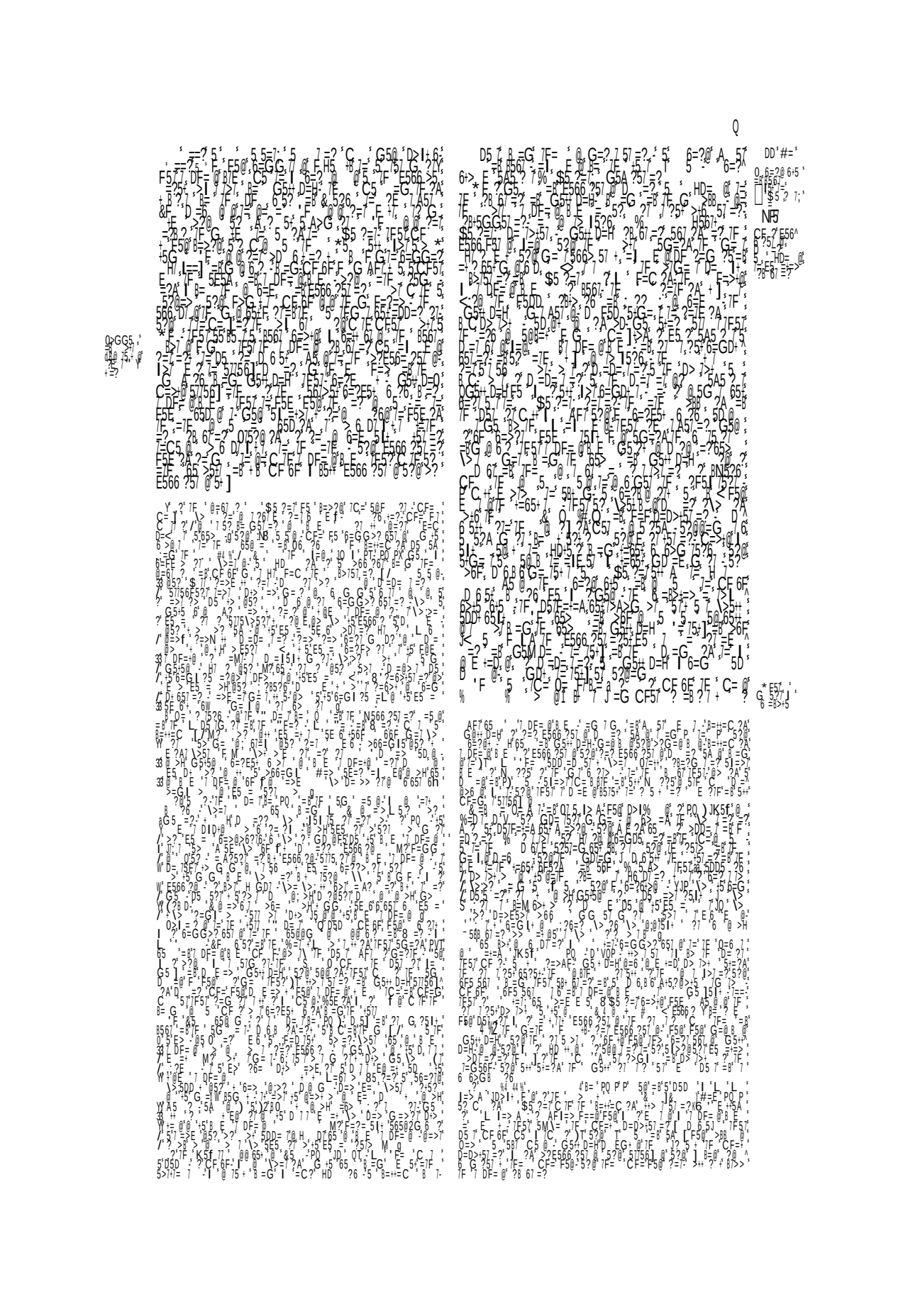

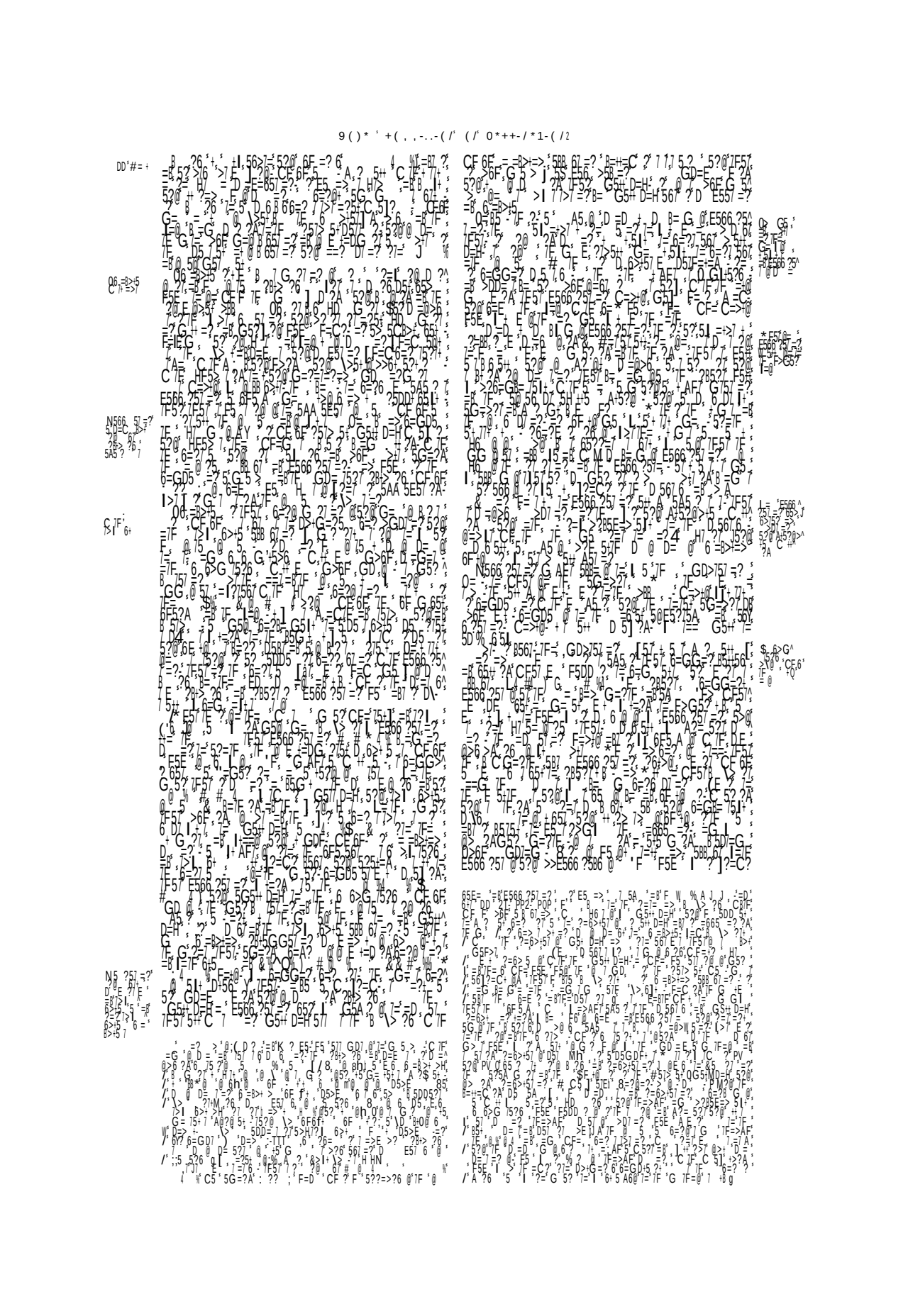

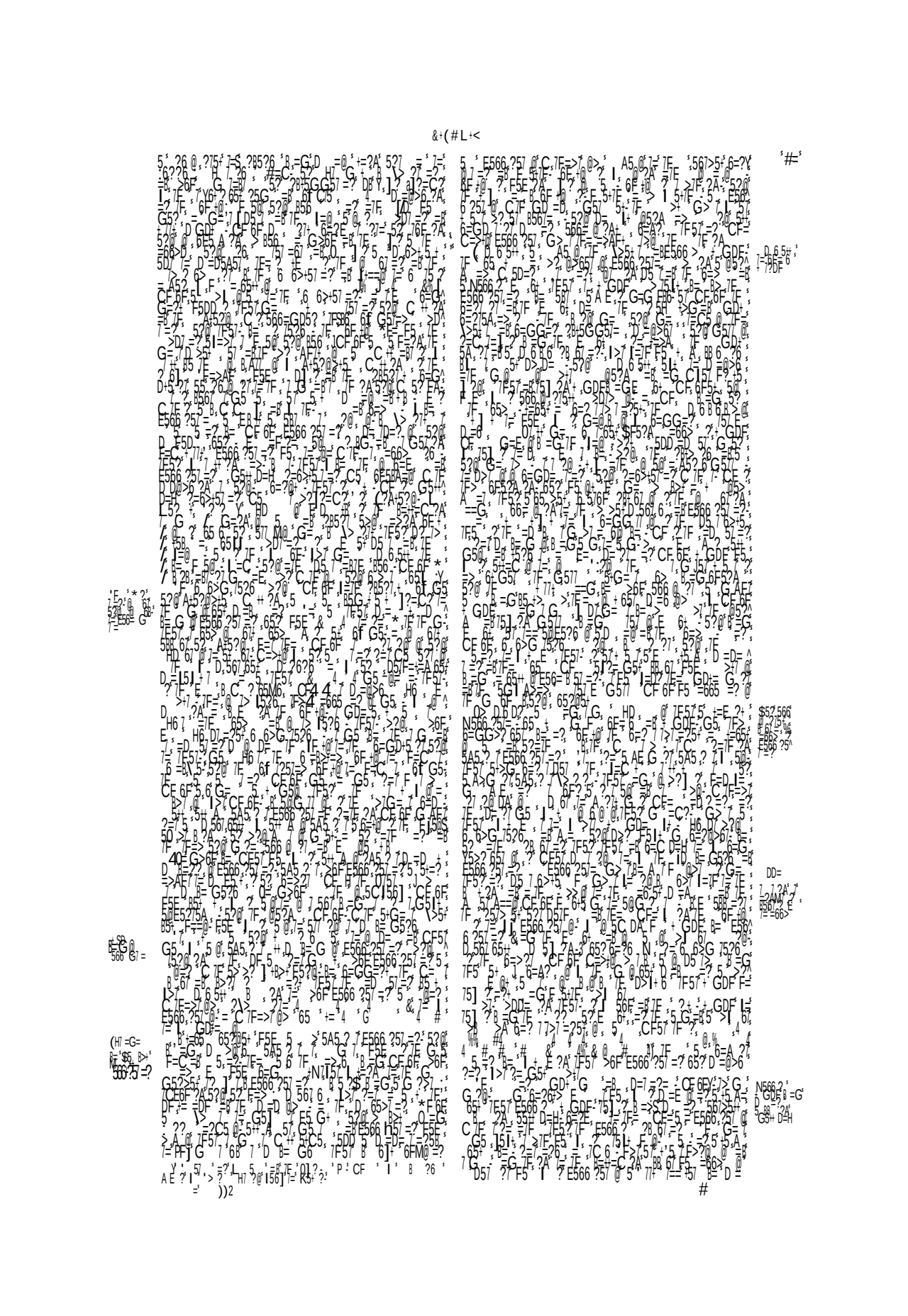

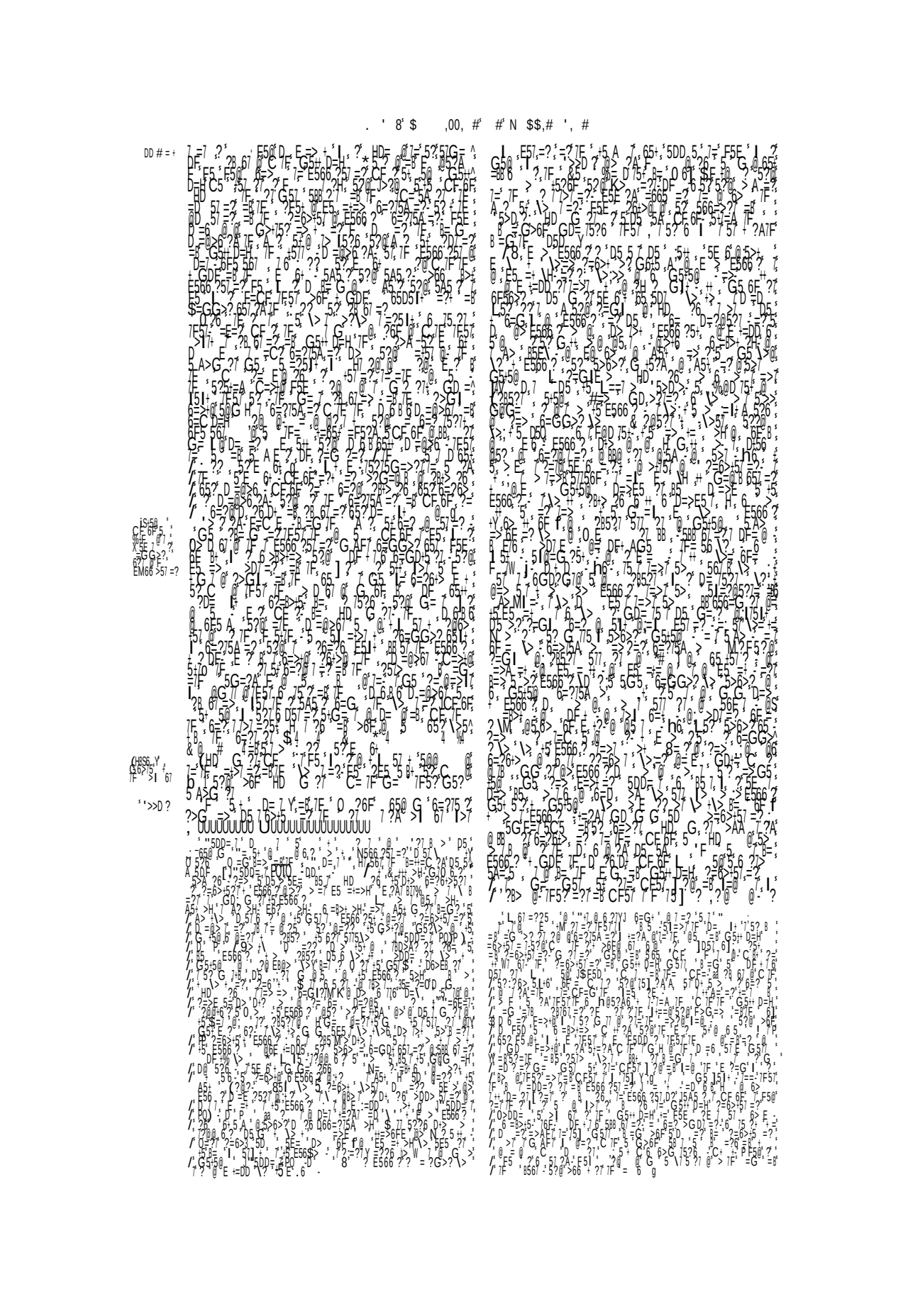

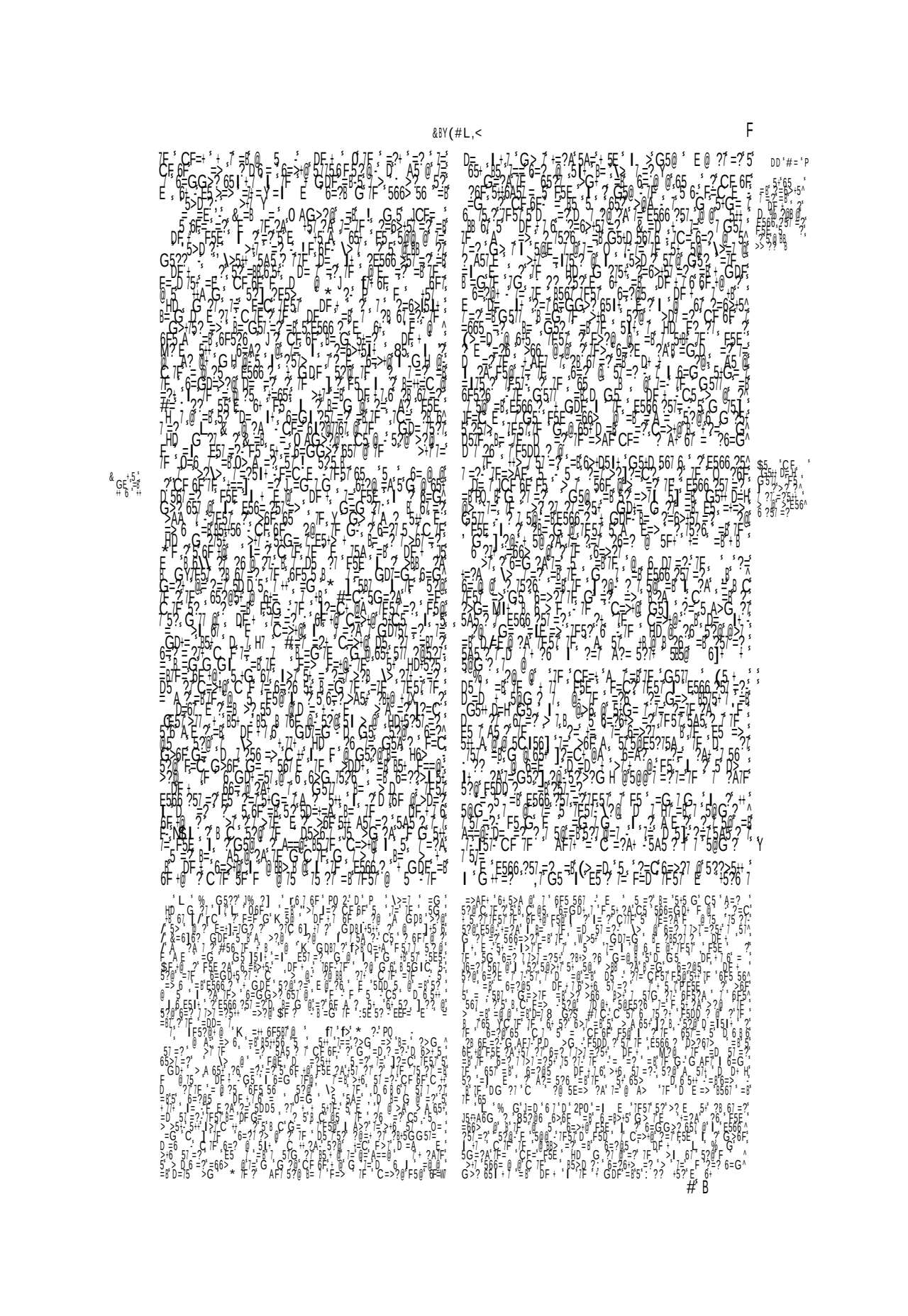

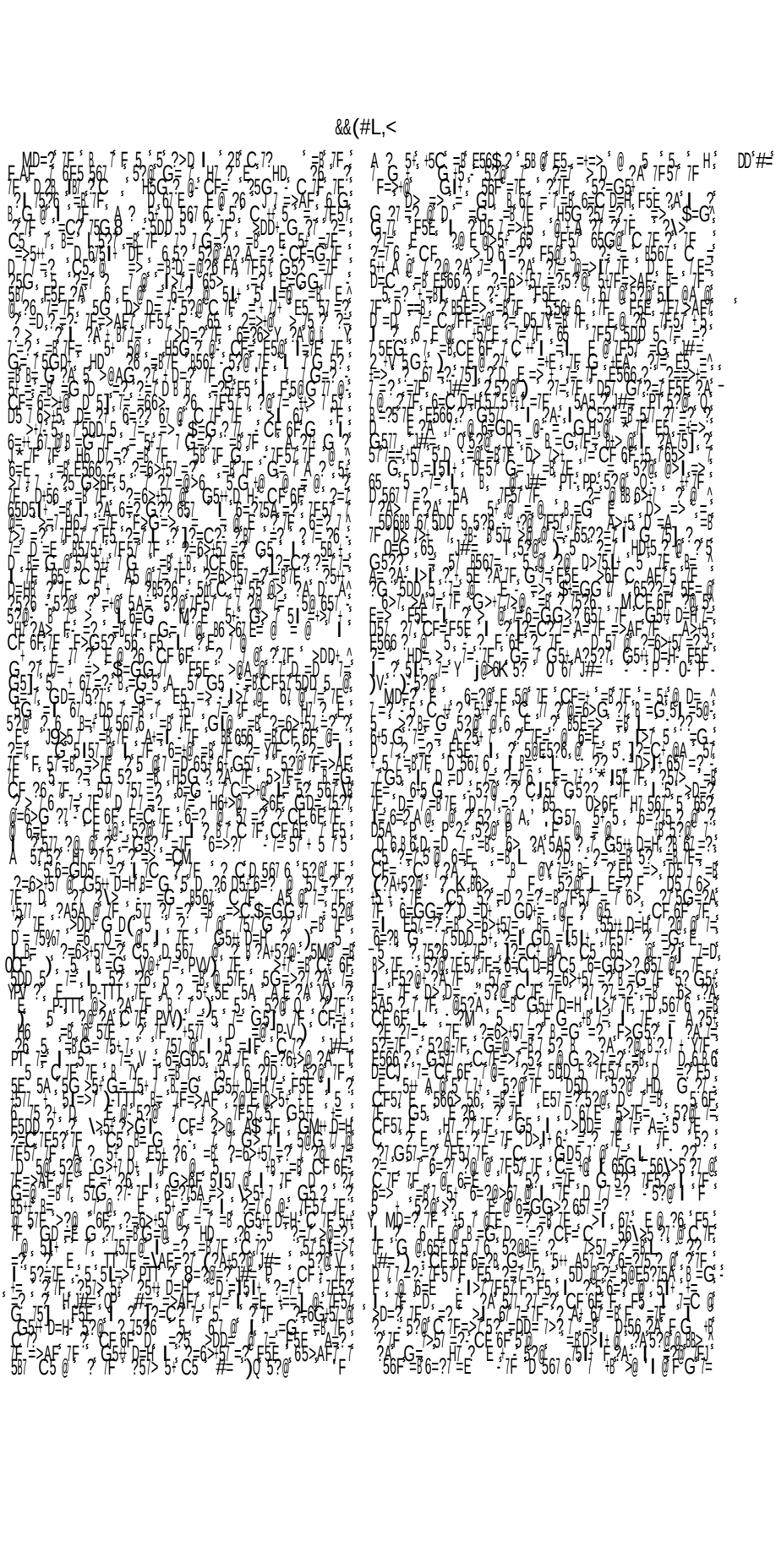

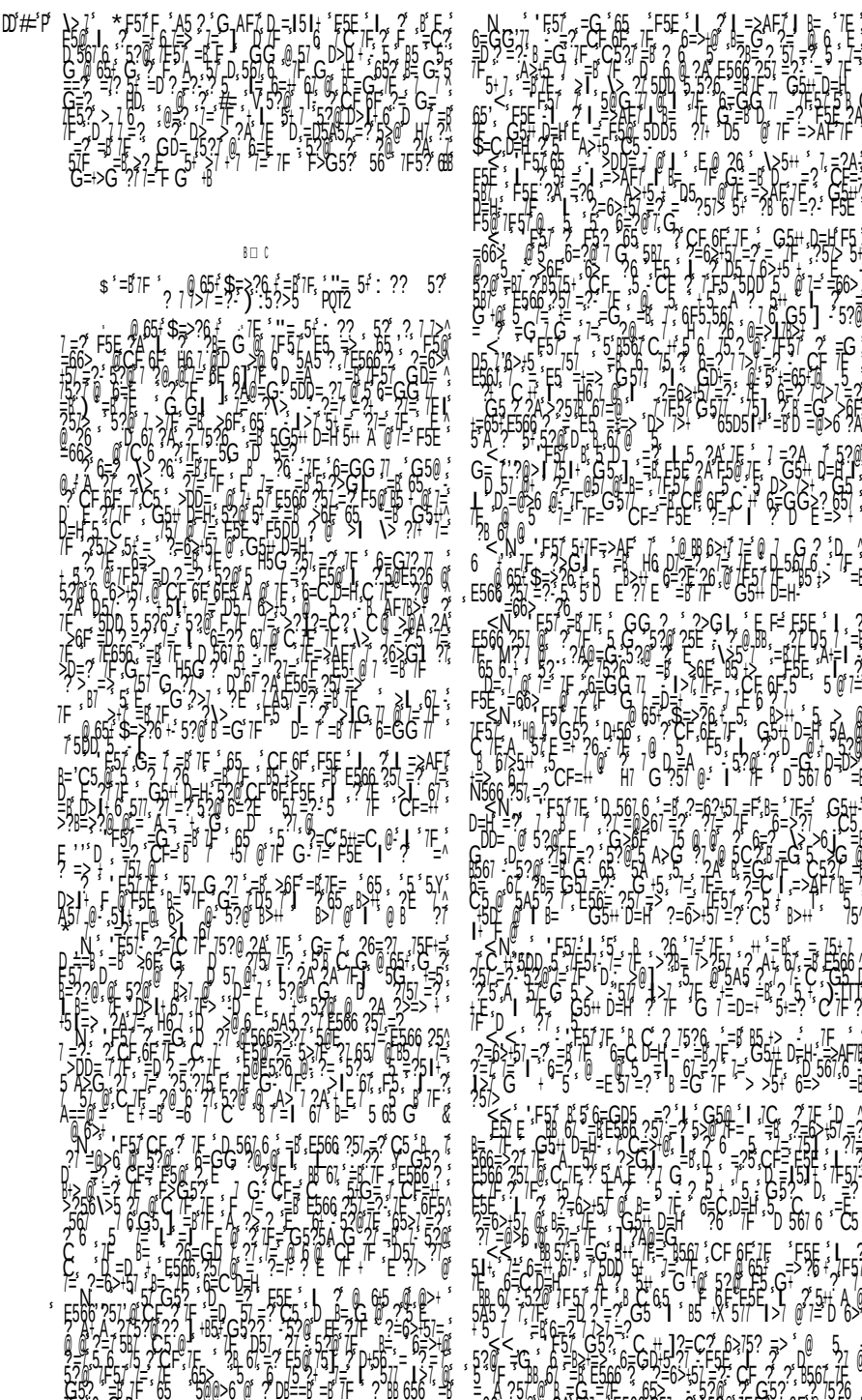

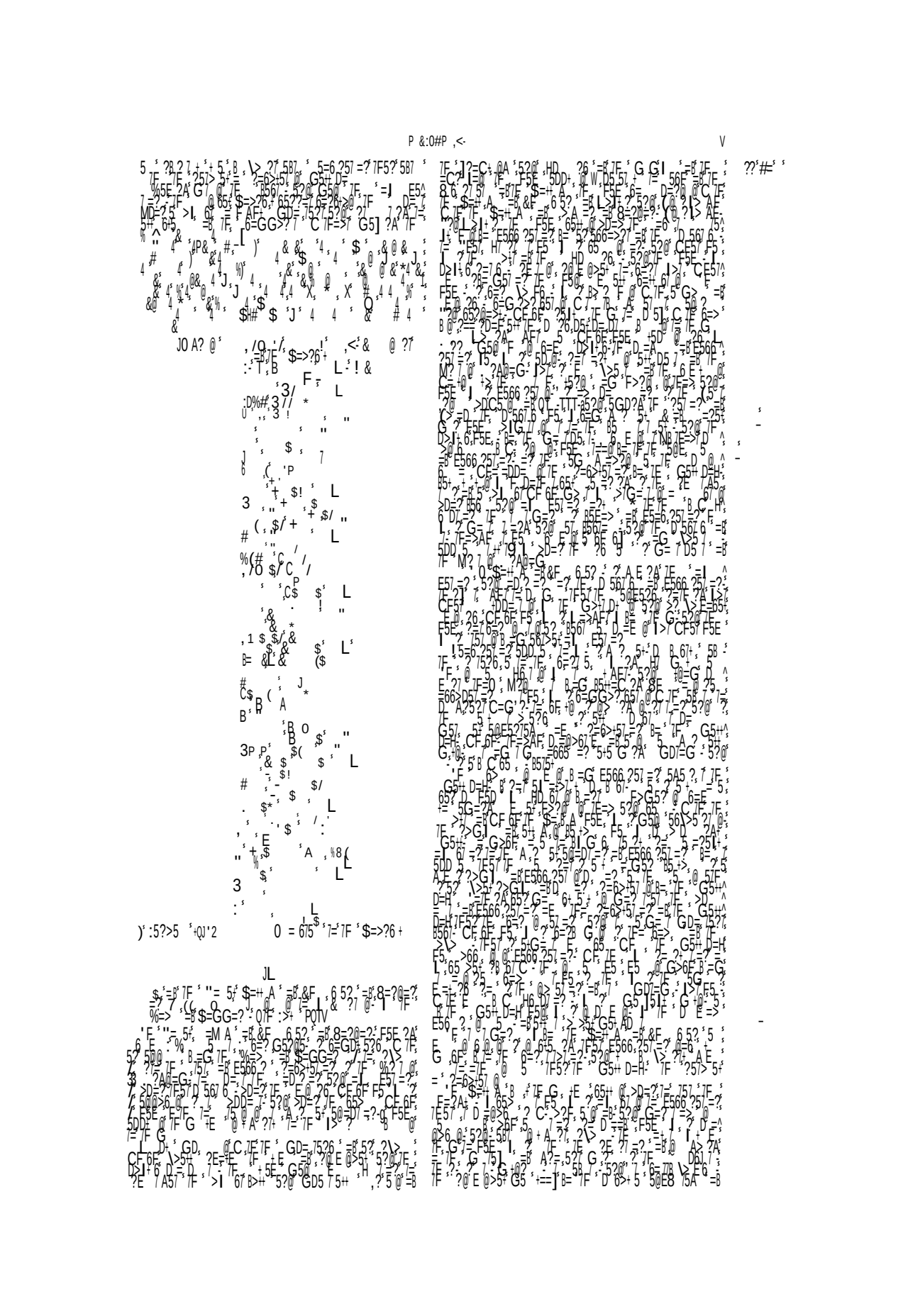

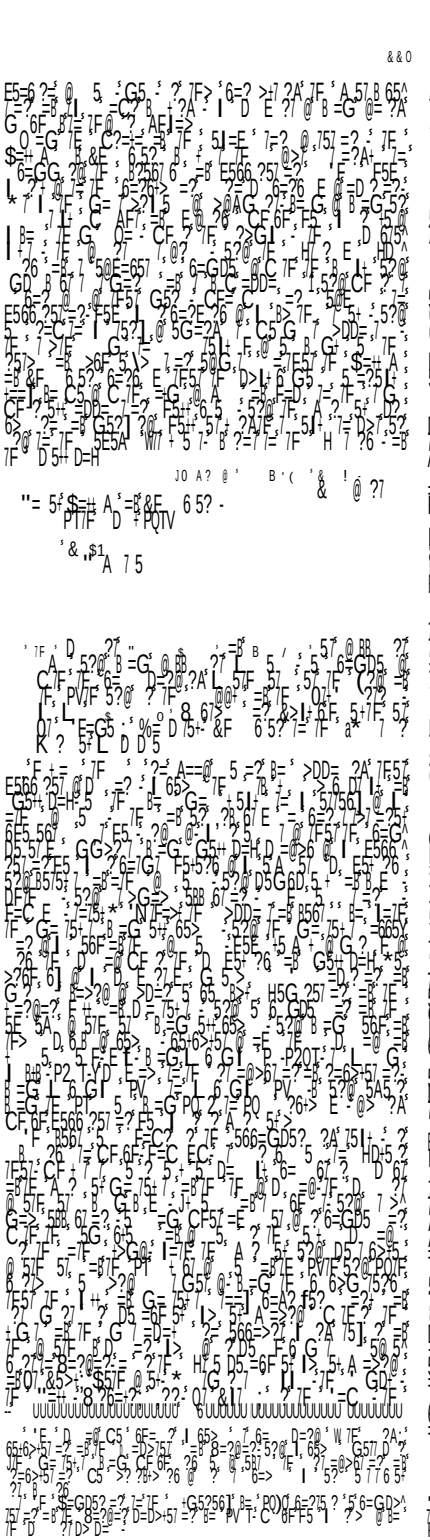

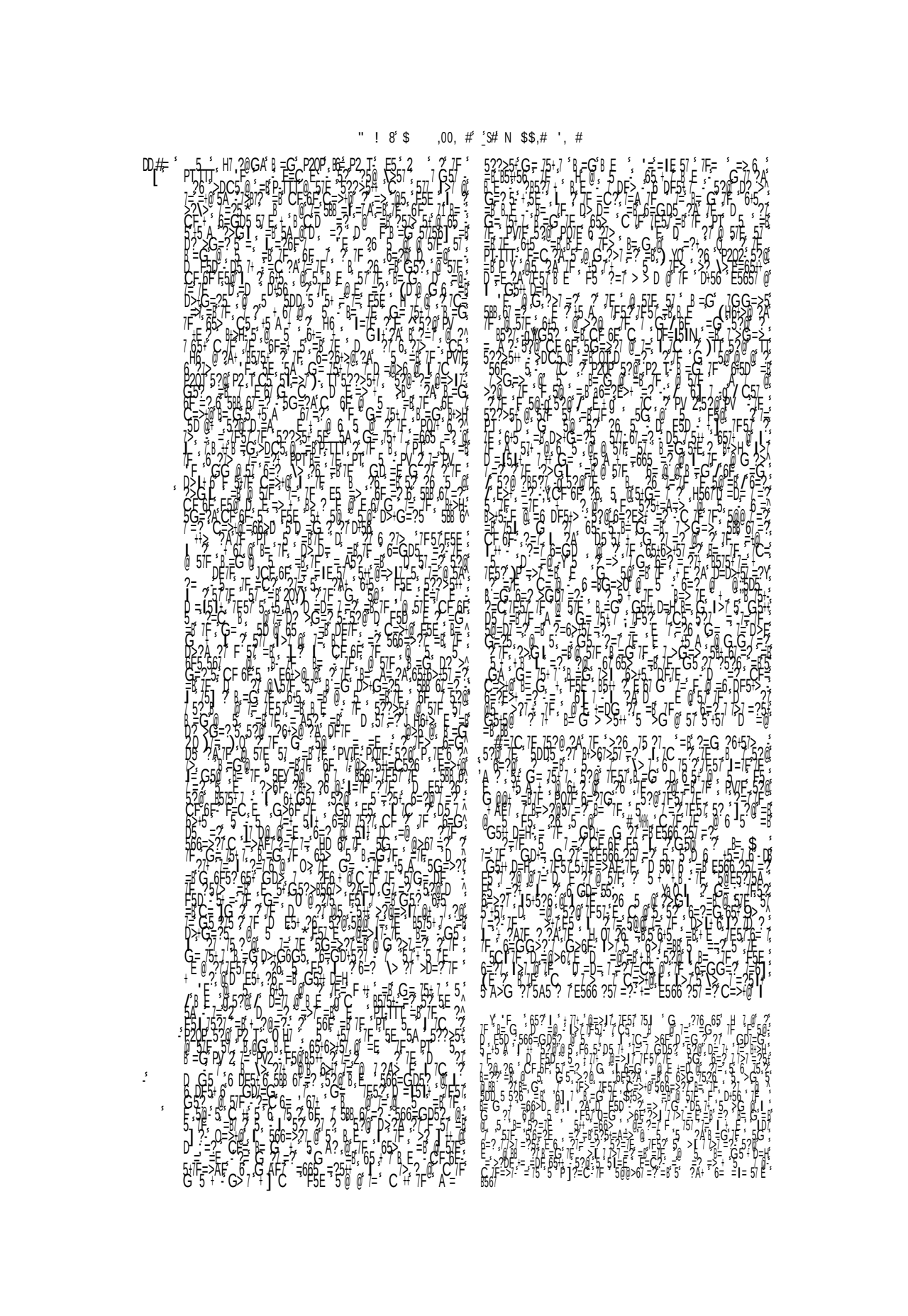

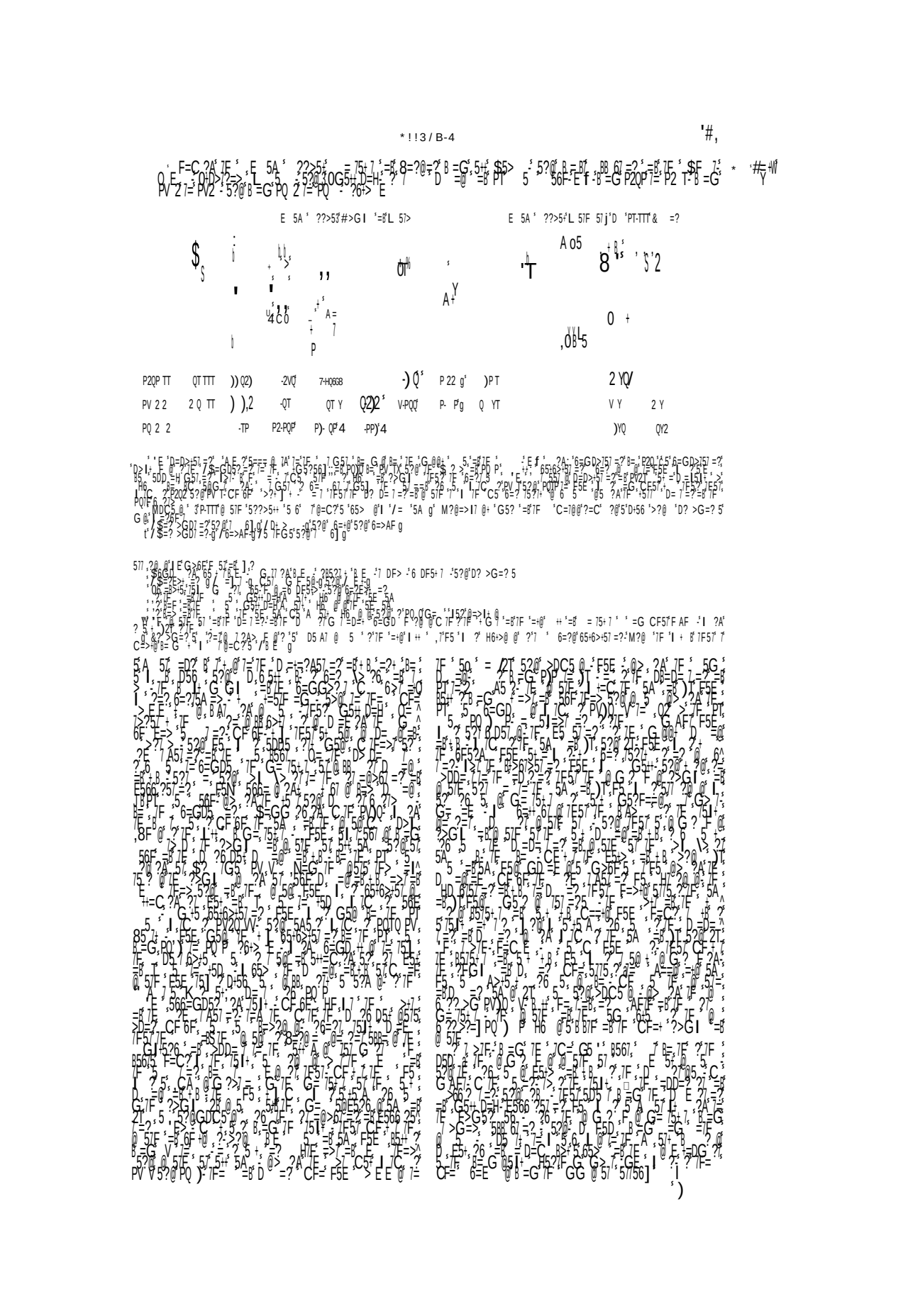

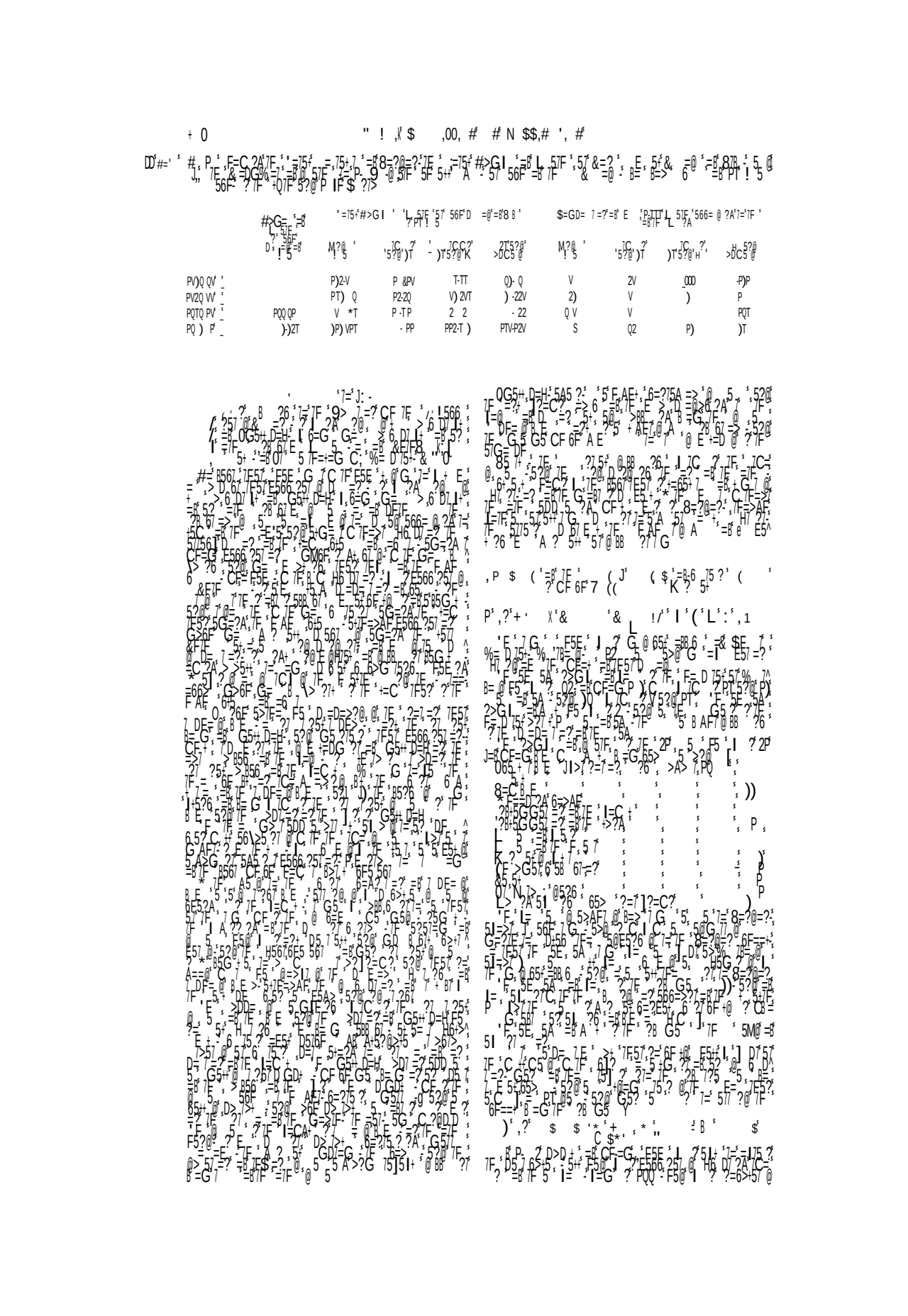

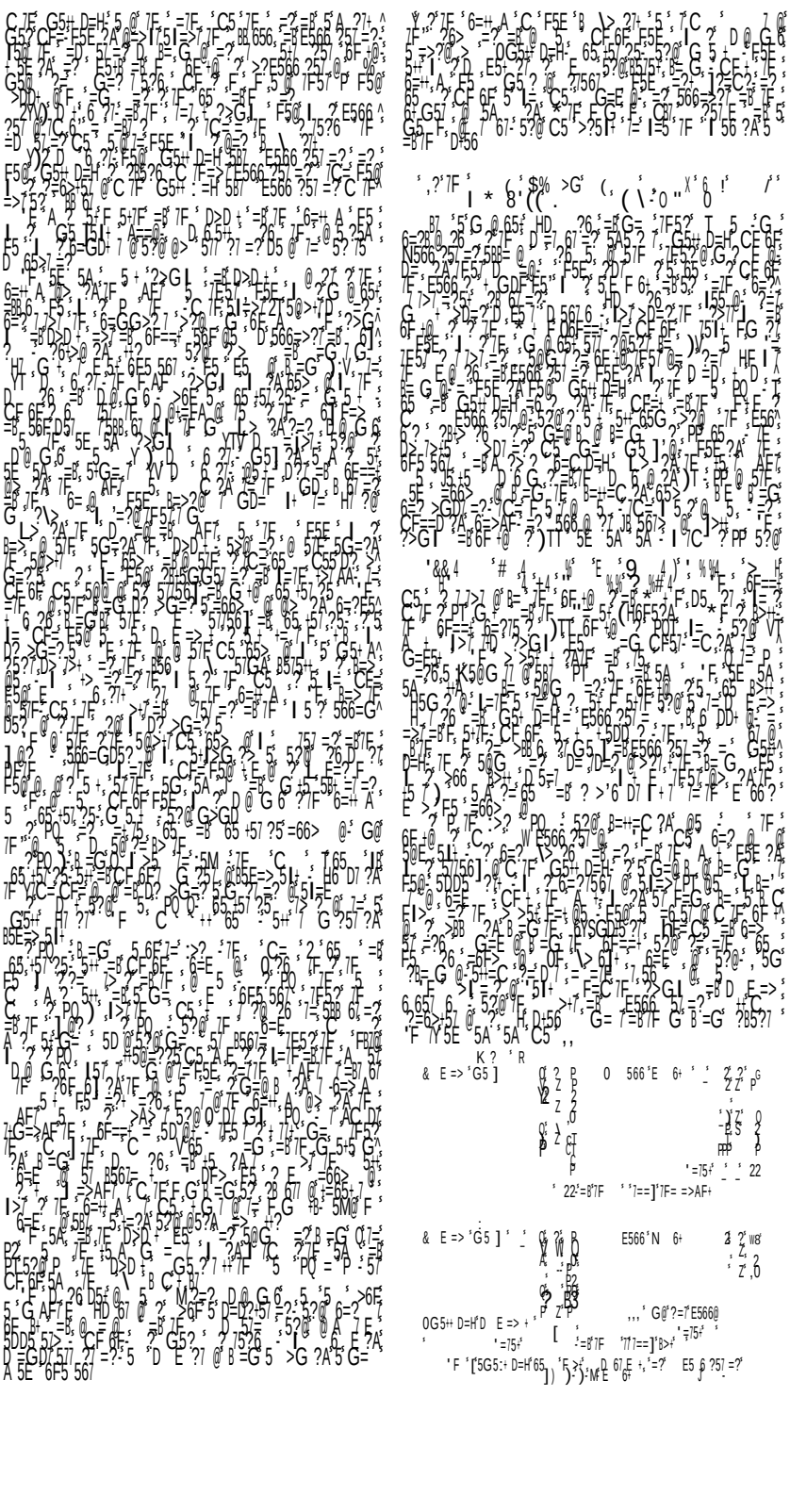

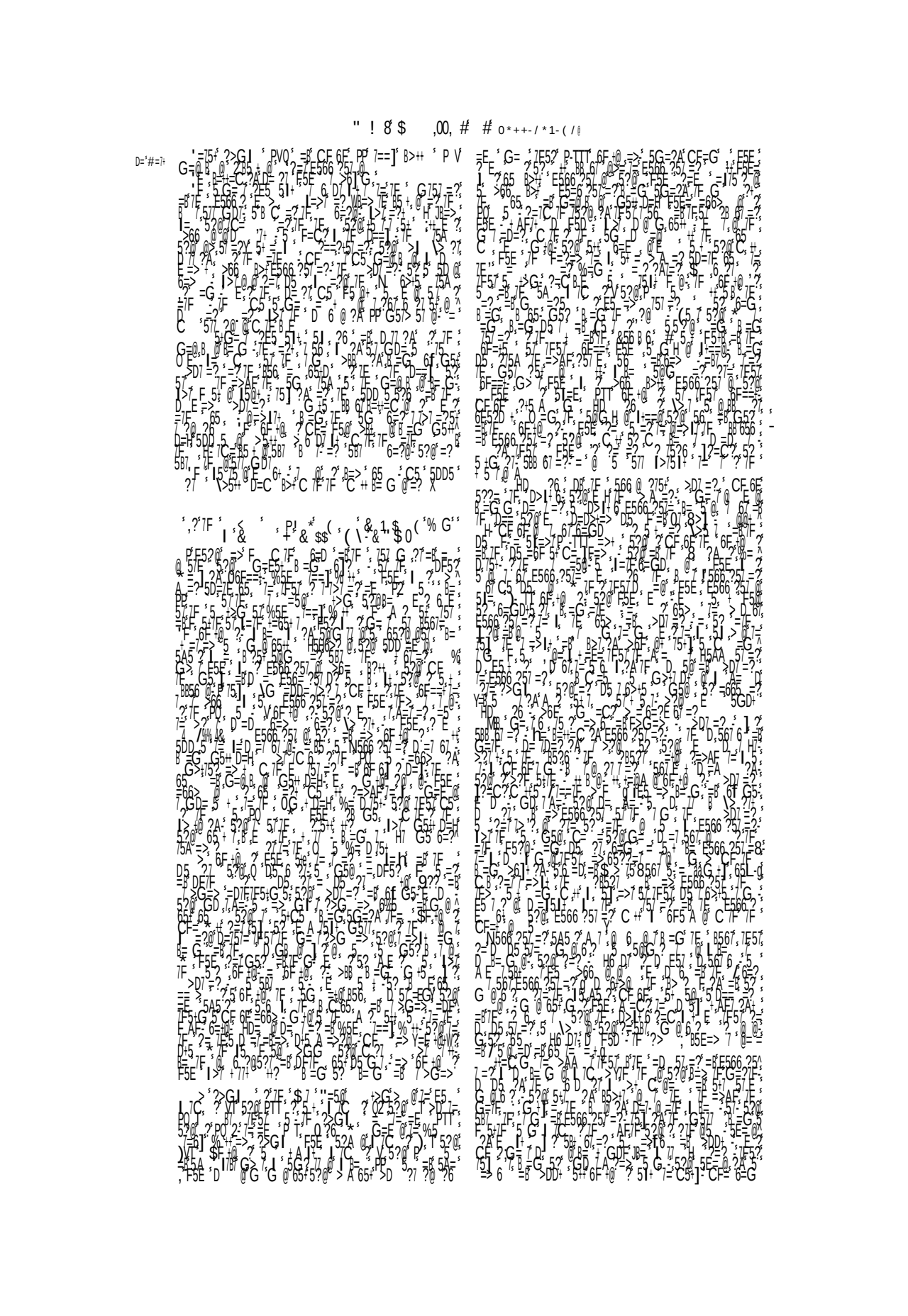

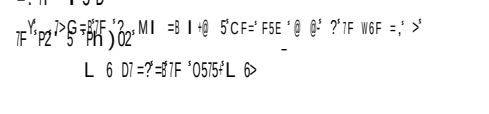

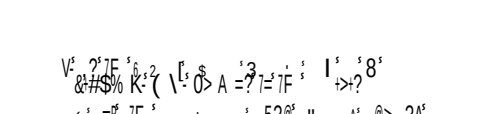

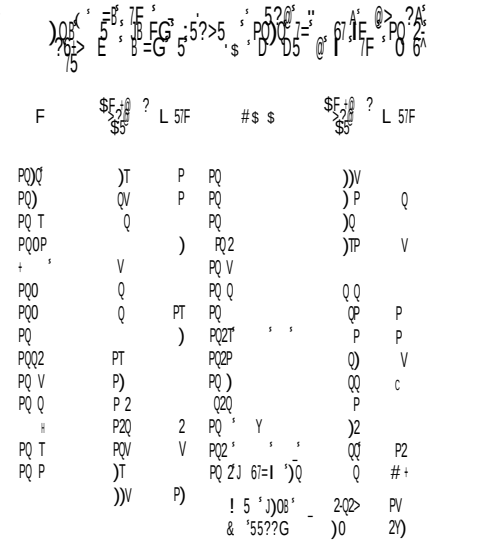

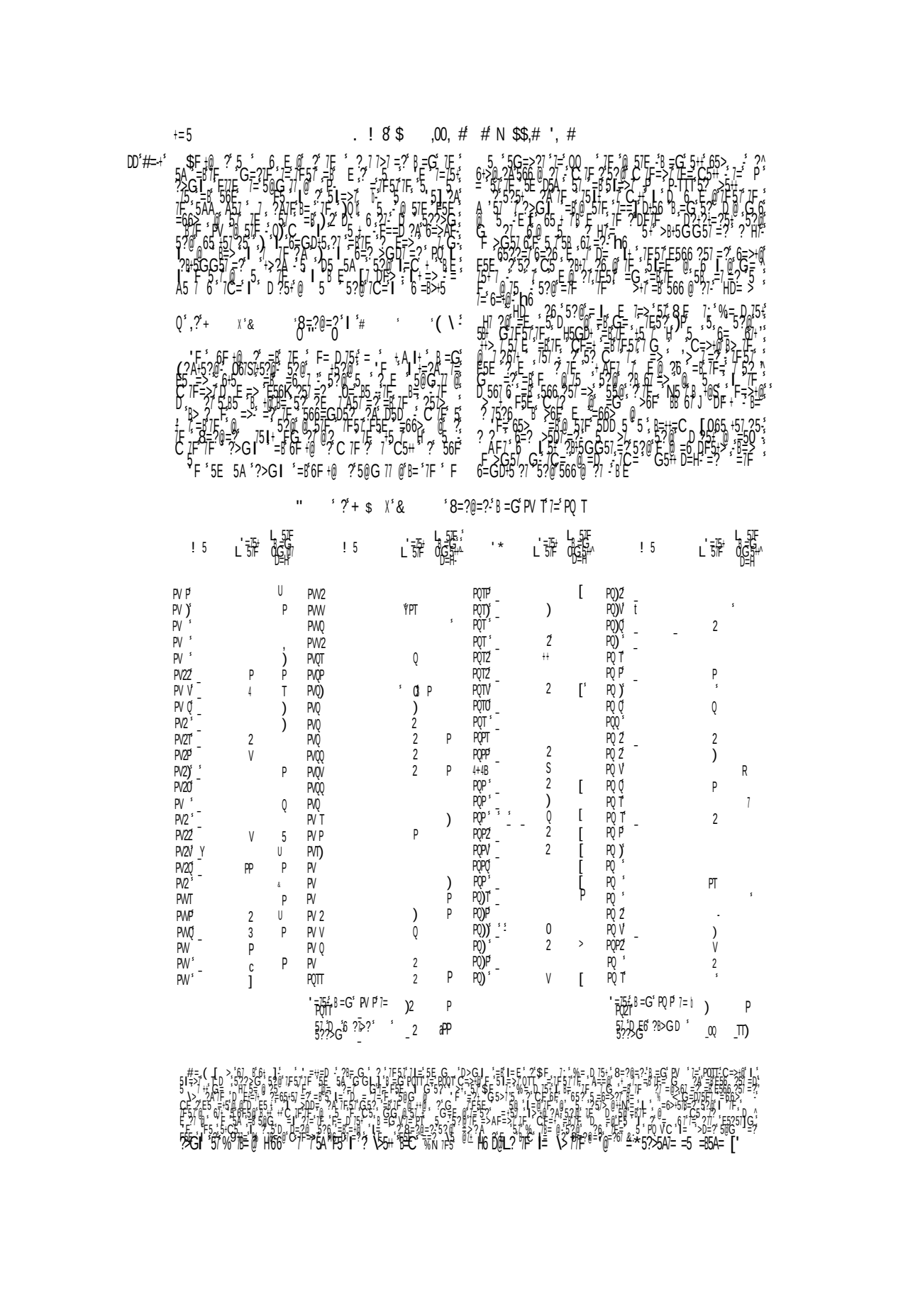

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=‘ G‘ G5++ D=H‘ ‘ (HD‘ ‘ ?6‘ D ‘=‘ 7F‘ E57‘ I> ‘ 5 ‘ D=G‘ ^
D5‘ 5‘ E‘ ‘ G5++ ‘ 2>GI‘ ‘ =‘ B ‘F= ‘ E566 257‘ B‘ 75‘ I ‘ 5 ‘ 5 ‘
5 ‘ 5? @‘ E‘ 7F‘ ‘ ‘ A‘ ? 5++‘ ‘ B=>? @‘ E‘ =‘ F‘ ‘ =‘ B‘ 7
G +@‘ ‘ 5‘ G‘ JE5‘ =+= @‘ ‘ ‘ J E5‘ 7F‘ ‘ G= ‘ 5‘ 7‘ ‘ B =‘ G‘
G5++ D=H‘ CF‘ 6F‘ D ‘ E=> ‘ ‘ 7F‘ ‘ ?‘ =@‘ 6‘ 7‘ -‘ B‘ E56 ‘
=‘ 257‘ =‘ 5G=>?‘ @‘ =‘ I‘ D ‘ 6 ‘ 7‘ =‘ B‘ 7F‘ ‘ 5‘ 7‘ 6 7 @‘ F5 ‘
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‘ E ?‘ ‘ ‘ + ‘ @‘ 5DD 5 ?A‘ 5B‘ ‘ 5 ‘ + G ‘ ‘ >25‘ ‘ =‘ B‘ ‘
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57756‘ ‘ 6=GD5 57 F‘ ‘ 5‘ ‘ >‘ GI‘ ‘ 152? ‘ 257 ‘ G= ‘ =C‘ ‘
‘ 7‘ ‘ ‘ A‘ ‘ 5‘ 5A‘ ‘ 7F‘ 57‘ =‘ B 7F‘ =‘ E566 ‘ 5‘ @‘ C‘ 7F‘ ‘ 5‘ ‘
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1 D‘ ‘ =‘ ‘ D‘ 7+‘ ‘ ‘ 7F‘ ‘ E566 ‘ 5‘ @‘ 5‘ B‘ C‘ ‘ 5 ‘ ‘
V5A=‘ 7F‘ ‘ E‘ ‘ ‘ 7F‘ ‘ 65‘ ‘ C‘ 7F‘ ‘ E=‘ ‘ CF‘ ‘ E5N‘ I ‘ ?‘ ‘
E566 ‘ 257‘ @‘ B =‘ G‘ PT‘ 7‘ =‘ 65‘ ‘ C‘ 7F‘ ‘ 5A‘ ‘ ‘ 5? ?6‘ ‘ ‘
‘ G5‘ ‘ ‘ =‘ I‘ E5‘ 7‘ =‘ ‘ 7F‘ ‘ PT‘ 7F‘ ‘ E‘ GI‘ ‘ 7F‘ ‘ ‘ 5 ‘ ‘
‘ I ‘ ‘ E566 ‘ 5‘ ‘ =‘ ‘ P‘ ‘ 5‘ ‘ 5A‘ ‘ C‘ ‘ ‘ E566 ‘ 257‘ @‘ ‘
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7F5‘ ‘ 7F‘ ‘ 7‘ G‘ ‘ F=>‘ @‘ ‘ ? 5‘ ‘ F5D‘ ‘ ‘ I ‘ 56‘ @‘ ‘ >D=?‘
‘ E ‘ 5? ‘ C‘ 7F‘ 6F‘ E=> ‘ =‘ A (HD‘ ‘ ?6 ‘ B> ‘ ? ‘ F‘ ‘ 7‘ C‘
6=GG‘ 26‘ G‘ ‘ ‘ A57‘ E‘ ‘ D ‘ =‘ 6 ‘ 7F‘ ‘ ‘ E566 ‘ 25B =‘ ‘ C‘ 5‘ ‘
‘ @‘ ‘ 5‘ 5C‘ 5?‘ @‘ ‘ ?‘ =@>‘ @‘ ‘ 7=‘ 7F‘ ‘ ‘ +5‘ @‘ ‘
‘ 7‘ C‘ ‘ 7F‘ ‘ +5‘ ‘ L‘ ‘ G5‘ ‘ ‘ 5G=‘ ‘ ‘ 7F‘ ‘ D=D@‘ ‘
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65‘ ‘ 2A‘ 5‘ ‘ ‘ 6 =B>‘ ‘ ‘ 6=‘ ‘ 7F‘ ‘ ‘ =‘ 25‘ ‘ B=?‘ 5A‘ =?‘ ‘
‘ B‘ ‘ DF‘ ‘ ‘ D‘ 7 6>‘ ‘ 5‘ 57‘ ?‘ ‘ =‘ ‘ F5‘ ‘ 5+‘ C5‘ ‘ I‘ ‘ ?‘
D5‘ @‘ ‘ ?=‘ ‘ ‘ 75] 2A‘ ‘ GDF‘ B =‘ G‘ 52‘ ‘ 2‘ @‘ E @>‘ 5‘ ‘ I‘ B ‘ 2A‘ ‘
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‘ I ‘ 5‘ ‘ ‘ C‘ ‘]?=C?‘ 7F5‘ E566 257‘ =‘ E5‘ ‘ J ‘ ?‘
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E‘ ‘ ‘ @‘ >6‘ @‘ ‘ 5? @‘ HDB‘ ‘ 26‘ ‘ E5‘ ‘ D‘ ‘ =‘ @‘ 7F‘ ‘ BB 656‘ ‘ 5‘ ‘
7F‘ ‘ 5‘ 5C‘ ‘ ‘ ‘ @‘ ‘ 5‘ @‘ E566‘ 257‘ ‘ ‘ =‘ ‘ E566 ‘ 257‘ ‘ ‘ 5‘ ‘
B7>‘ @‘ ‘ HD‘ ‘ ?6‘ ‘ E5‘ ‘ ‘ ‘ C‘ ‘ ‘ =‘ C‘ ‘ 7F‘ ‘ >66‘ B>‘ ‘
‘ >‘ ‘ =‘ B 7F‘ ‘ +5C‘ ‘ ?5‘ G>6F‘ 5‘ 7F‘ ‘ 5‘ ‘ 6‘ ‘ 5‘ ‘
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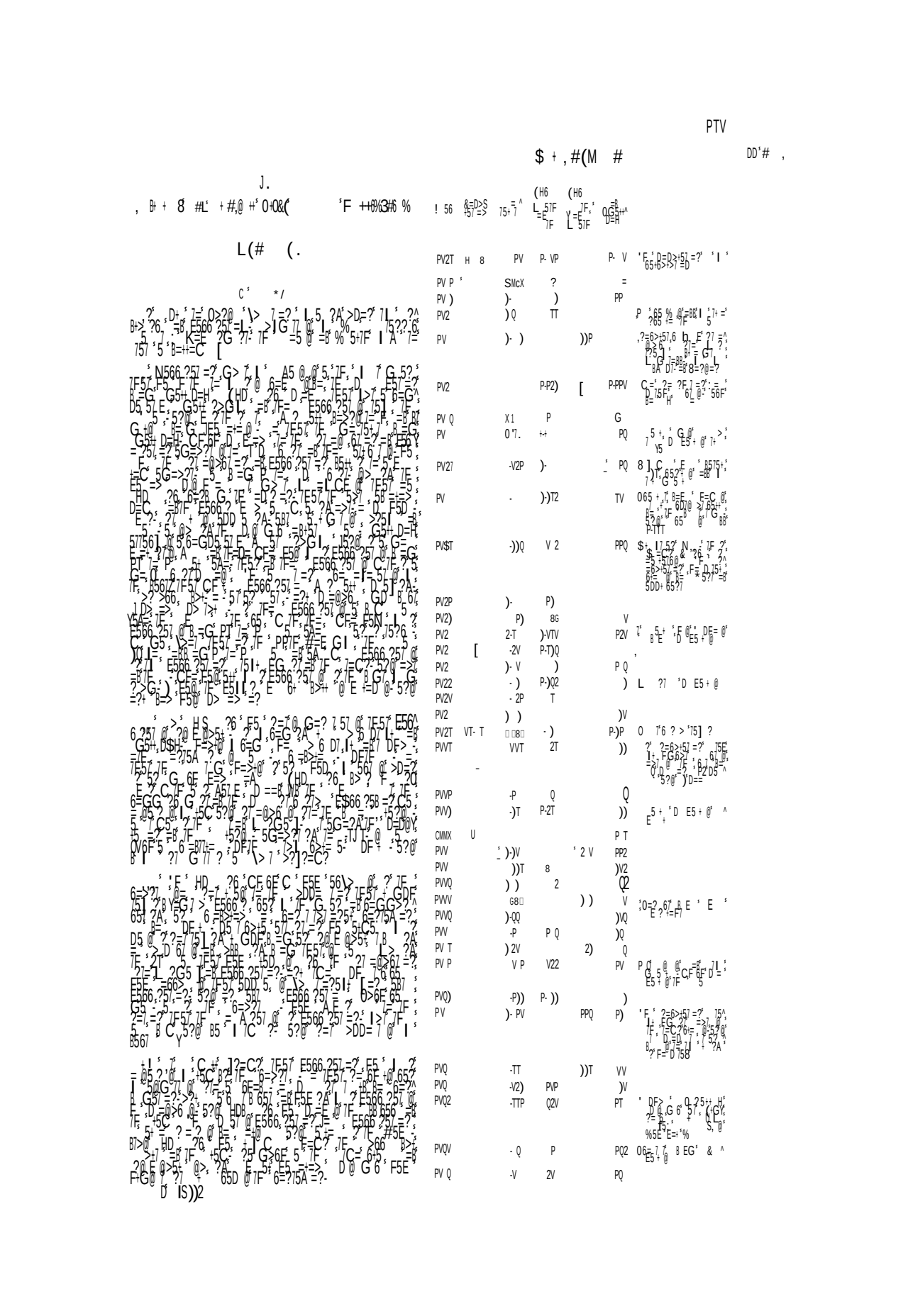

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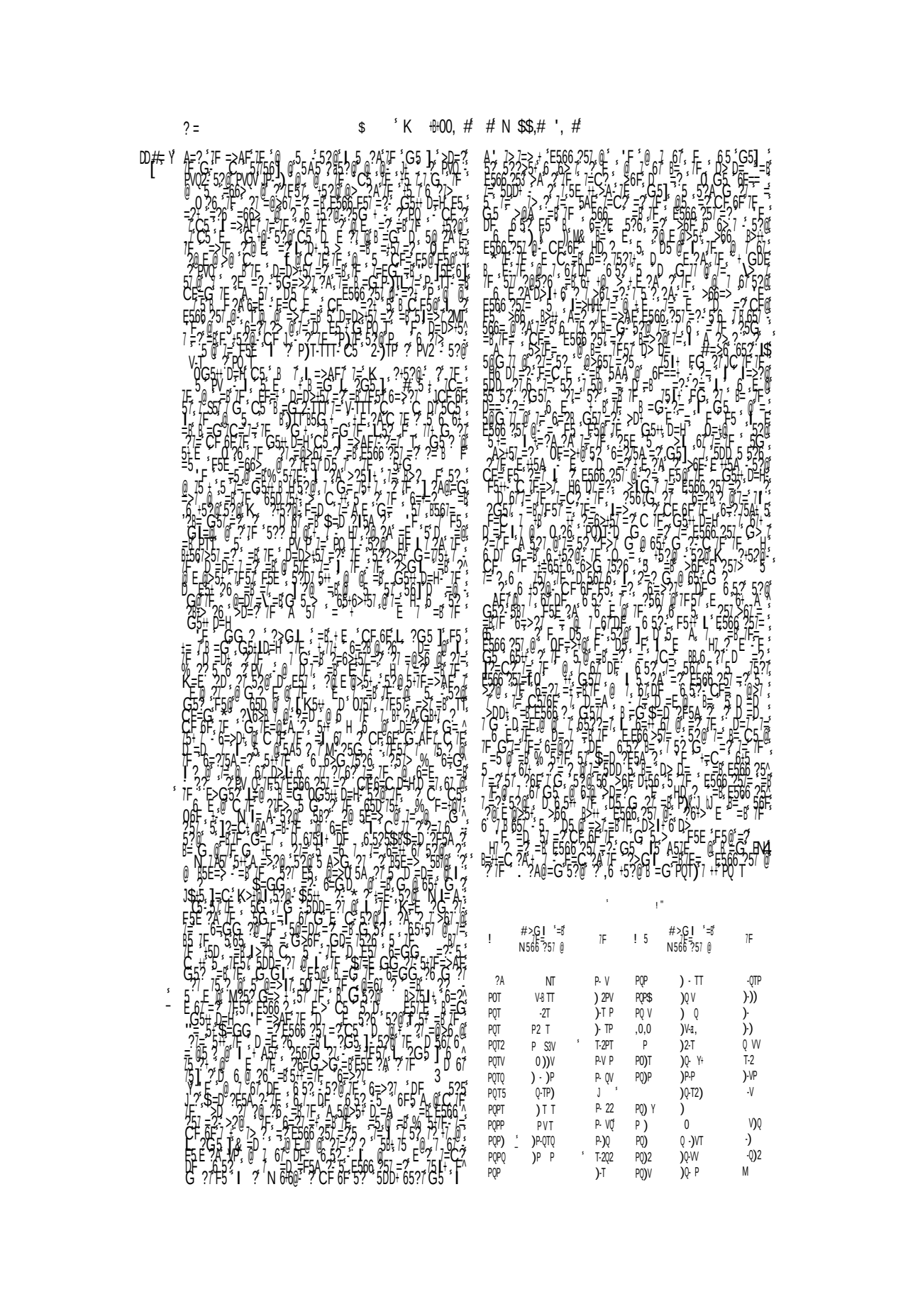

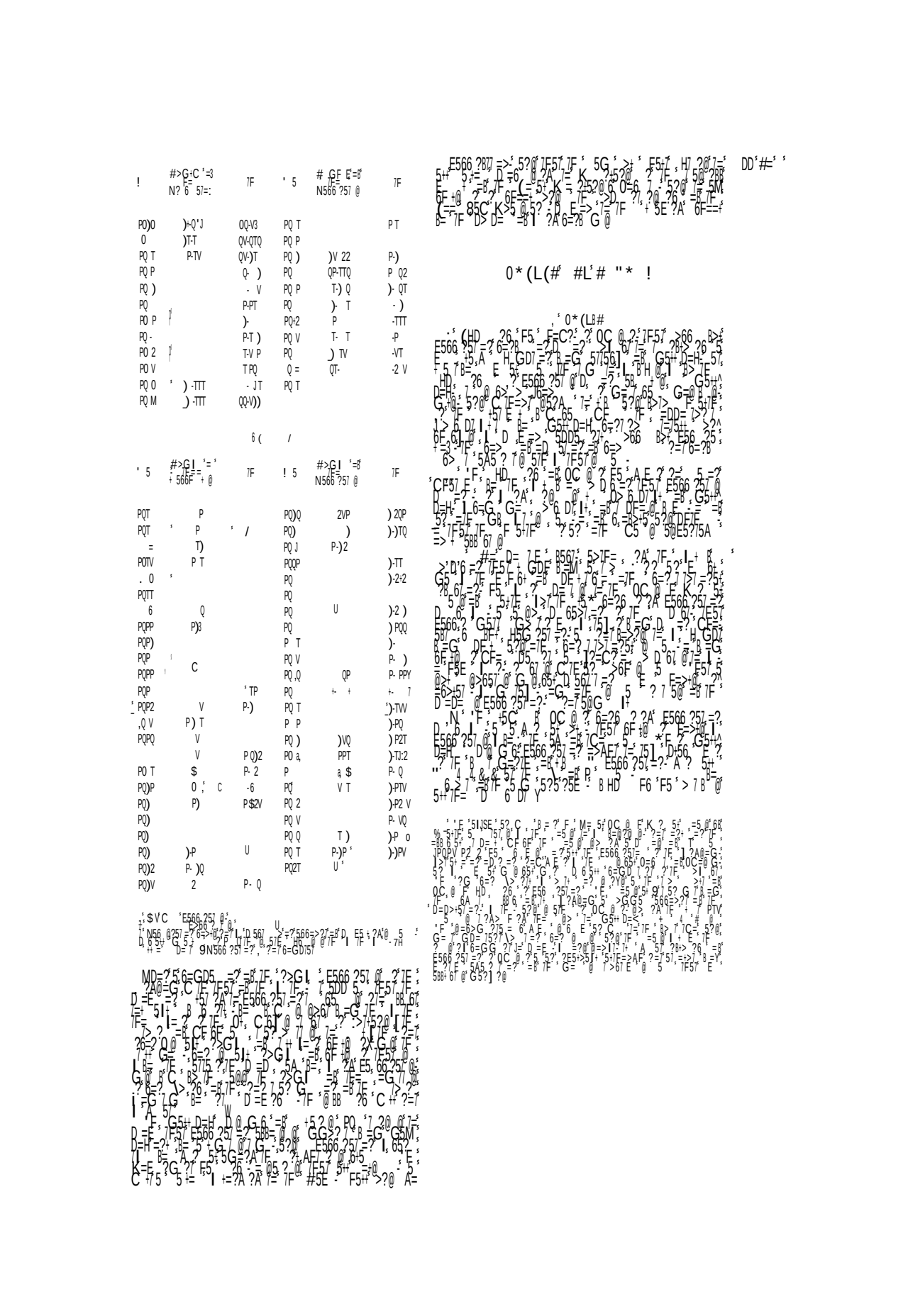

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PQTQ		VQ?2O	Q)- PP	P-QP	P))V
PQT3		2< TT	Q-2)	)- T	)P-PVP
PQPT	)QVV Q P	VQ- P2	V -2TV	Q)	P
PQPP		Q -	2T-) 2	2 Q	V- QT
PQP)		V)-T)P	V -T 2	T	Q-T Q
PQP		V -Q V	22-)22	V	2 2P
PQP		V -Q V	2 - 2	TQ	-
+	) T2 2	5O	2V-2)	V)	)
PQPQ		W-2	2-))	2 T	T
PQPV		Q -Q)P	2T-Q2	))	2-VQ
PQPQ		2 -VP	2P-V	T	2 Q
PQP	/	Q -) T	T -QQP		V PT
PQ)$	)QQ -2 T	Q<Q P	2)- T	P	2 VV
PQ)P		)-TV)	22- P2	V	-Q2
P		- T	-Q T	PP	-P P
PQ)	)-2QV V	Q-)	2-T2V		-P22
PQ)		- W	22-) 2	2PQ	O TQ
PQ)	)-WP-))	PTT P	2- 22	P-)	- 2)
PQ)2	)-QT - T	V-P)	2 -T)V	2)2	)
PQ)V	)-Q)Q- 2Q	QQ-P Q	2<)T	2TT	-QV+
PQ)Q	)-Q Q-T2)	-	V -Q2T	) V	-Q V
PQ)T	)-Q2<QQP	- QQ	Q)-VP		)2
PQQT	)-QQQ TQ)	) 2	2 -) Pt	,	V-
PQ P	)- TP-T2P	QQ-)	V -)V	2<)	
PQ)	B)	Q -Q2)	2Q-TVQ	2))	S
PQ	)- -) V	PTT- T	2 - V	P-P 2	
PQ	)- Q -P	PTT-) P	V2-)	P-T T	
PQ	-T) -	Q-P	2-V Q		
PQ 2	-T2P-	T-Q2V	2T V2	P Q	
PQ V	-TQ	-2P2	V -2PP	2P	
PQ Q	Q-T 2 N=Y'	T-22	V< T	P T2	
PQ	-,P 2	P-Q2	V)- QQ	V	
PQ T	-P Q-QQV	Q-P2T	2 -	2 T	
P P	-PVO- W	T -V	2P)V	) V	
PQ)	-)TV-P P	PTT- V2	2i PW '	Q	
PQ	-) V-PQT	-P	S2 -PP		
P	)V -Q	PT -2 Q	22-TT	2	
PQ	Q- P2- 2	Y'PTQ-22T	T V	2	

= 75+ 7 '@> ?A'7F ' ! 5

F $	&=D>+5^ =? 7E ' ?@=# @>% 7F ' ! 5	'=75+	O 0G5++ =G D=H	& =G 5?@ DLF= @
PQ 2	<Q 22	-VT	V<22	)
PQ V	2 - T	-PV	V - T	P
PQ Q	Q P	PT))	22- P	VP
PQ	- -QT	PP) T	2V-Q)	P
,Q2T	- Q< P	PPT	2Q-2<	P-QV2
PQ P	P2 Q	PPP-T2	V)-2T2	) - Q
PQ)	P	PTQ- T	QT-T T	P-
PQ	2)-	PPP- TV	Q -T V	)V
PQ	<2T QV	P)T-PTV	VT-Q 2	)T
PQ	-)	PP2-TV)	VV-V	P

R' % $O

' 'F '$=G7= 77 '75H '5?C '7F ' \> 7 =? 5BB G5 7E ' D? 'E CF=+ ' I' B '27 ' =? ?' D@ ?= G5 I' E57' @< ?A' D =B' 27 =? ?' D@ ?= G5 I' DDH' @< ?A' D =B' 27 =? ?' D@ ?= G5 I' CF=F5E' I' E566G57 @ ' 5 ' 5 ' 5

" ! 8 $ '00, . # N $$,# ', #

DD #=)

&&(#L,< ,8

> ; % & & J A * :
& & 4 , ! ! "

#K8 % #L * 8(0

" B =G D= G ++ =? + E ?A- PQ Q)
5?@ PQ V

! 5	L 57F	! 5	L 57F	! 5	L 57F	! 5	L 57F
PQ Q	P T2	PQ P	00	PQ2	2V	PQVV	3VQ
PQQ		)Q)	- TP	PQ2	TQ	D+QVQ	
PQ T	22P	PQ Q	PV	,Q2T	P P	PQV	A
PQ	TT	PQ	P P	PQ2V	PP2	PQQT	)T
PQ)	PQ0	PQ-	PP	PQ2Q		PQQP	P)
VQW		PQ 2	?=	,Q2T	VW	PQ0)	)
PQ		PQ V	)JN	PQVT	PP2	PQQ	
PQ		PQ Q	QP)	PQVP	: TP	PQQ	QV
PQ Q		Ph	)	+B6	Q)	PQQ	PTV
PQ V	2	PQJ T	PQQ	PQVQ	PTP	PQQ2	P
PQ Q	P V	PQQP	22	Y	:77	PQQV	<
PQP		PQ2)	QT	PQV	T		H
PQ T	)T)	PQ2	)Q	PQV2	PT		Y

% ['F 5+CE= B+A> 6 I6F @> J '657F B =GEF86]6? D=

B =G P 57 >66 E
+ B D =@ PQ V 2 Y PQ VP- 5?@ PQV) QV

; T YPT * P P) ') WD

20 PP)

$) N566 ??7 =?
=5 = 7 %, G 7 ?=7
6= @ ,0 0 + :
J5 N566 ?57 =? =* Y
&7 = ; + >7 ? =
6 6=@ 7 ; 6?
7 6=@ 7 ; E6 ?
?57 = ? =
PQV) QV

2=7 C 7F PQ 7 ; 7F 7 =@ =D7 =?5 E266 57 =7 A ? C 7F PQ PQ
C 7F 5A M?7 + PQ V

U

3 =@ D G ++ =? + E ?A 57 56F >6F + B D =@
PQ V -PQ VP- 5?@

& =@ 5A ++ T PT PT P P) >DC5 @

PQP' 02 P P E ,0 PP + M PT
PQ VP QVT P) V VP QTV T22 V)
,QV) WV 2V)2 V P)V)

7

#>:7 F=Q F A =E 5?@ 7 M =? 15 F= ? @ PT 65 =B
5A *F= @ B =G 0G5++ D= ? (?A+5?@ 5?@
*5+ H M

N="6 5C7 =?57$=?@ 7 =? D657F PQQP QV

N566 ?57 @ P
M?E?66 ?57 @ P-)V
#= 757 G ?7 _ _ P P- PP)

' =75+)- VP

=7(' 7= ?2E566 ?57B7@ 5 = T D 6 ?7 =B 7F= 5 7 CF= =
N566 ?57 =?5 6=?@ 7 =? 7F C5 7= = 57 = 5?@ 0 T D 6 ?7 =B
7F= 6

,

&?=D= ' D# =B " >?@ @?@ =E P 5 =B 5A
D , P TTT @ 57F B =G 0 >0 + D9< ? N566 ?57 @ 5?@
2E566 ?57 @ & =7 D 57 E + PQQP QV J 7F
6+>@ ?A @ 57F >?@ 7F Y f?=?7F

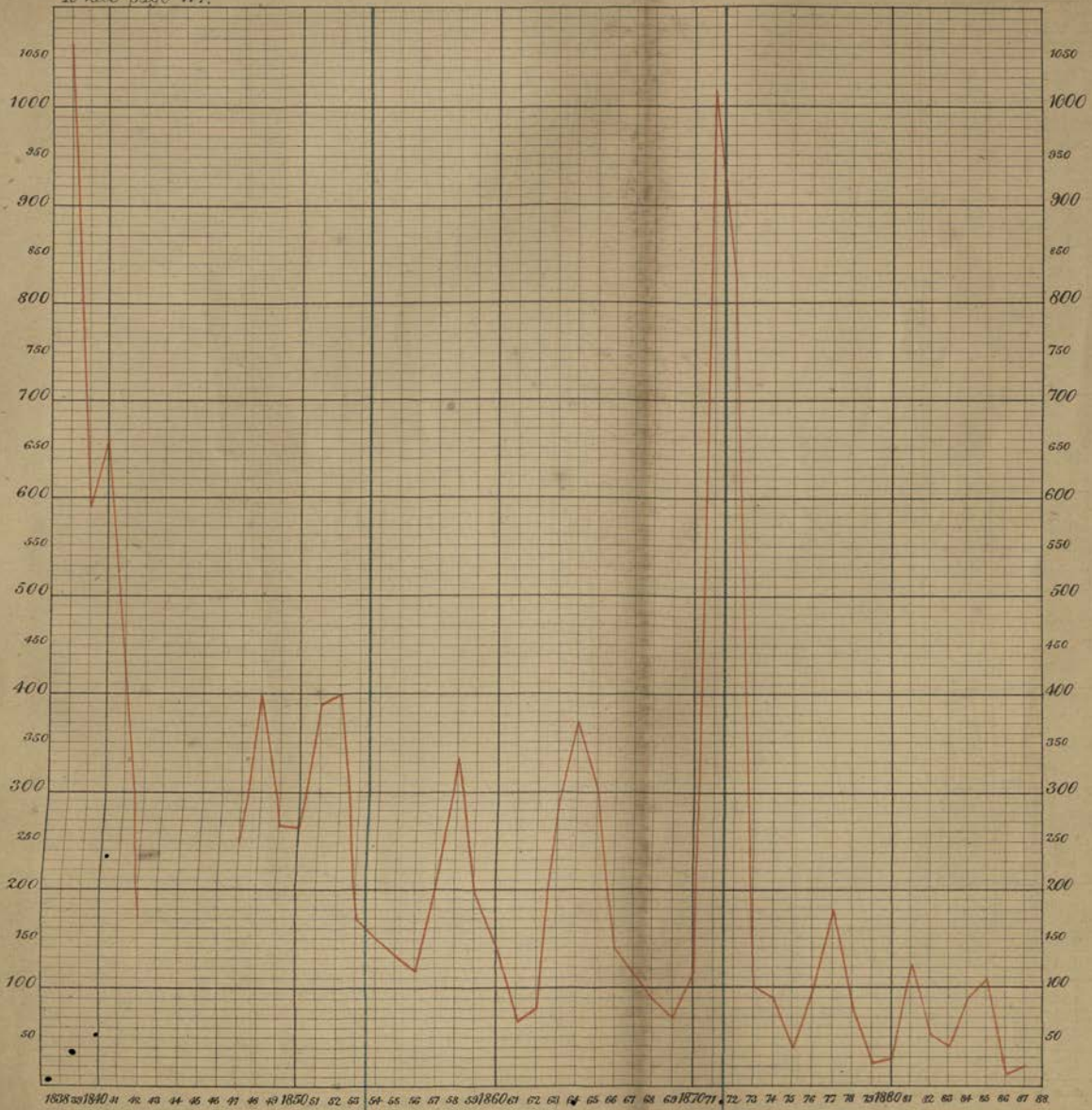
A= M5E566 ?57 @ P N566 ?57 @

'+ $G=?7F 57 @ Y?@ P 57 _ 2* P)Q
0 B7 ? 5 5?@ >DC5 @ 2 0

+T :

THE RATES IN TABLE A IN FORM OF A DIAGRAM.

To face page 114.



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&&(#L,< PP

' & DD'#='□

0C 88 =H ?' 'C 5G '=B'7F '+5 A 7', * '# ' ?'7F ' ' 5 'PQVT V

L 57F 'B =G'0G5++ D=H ??>5+'" 57 'D 'P-TTT' _

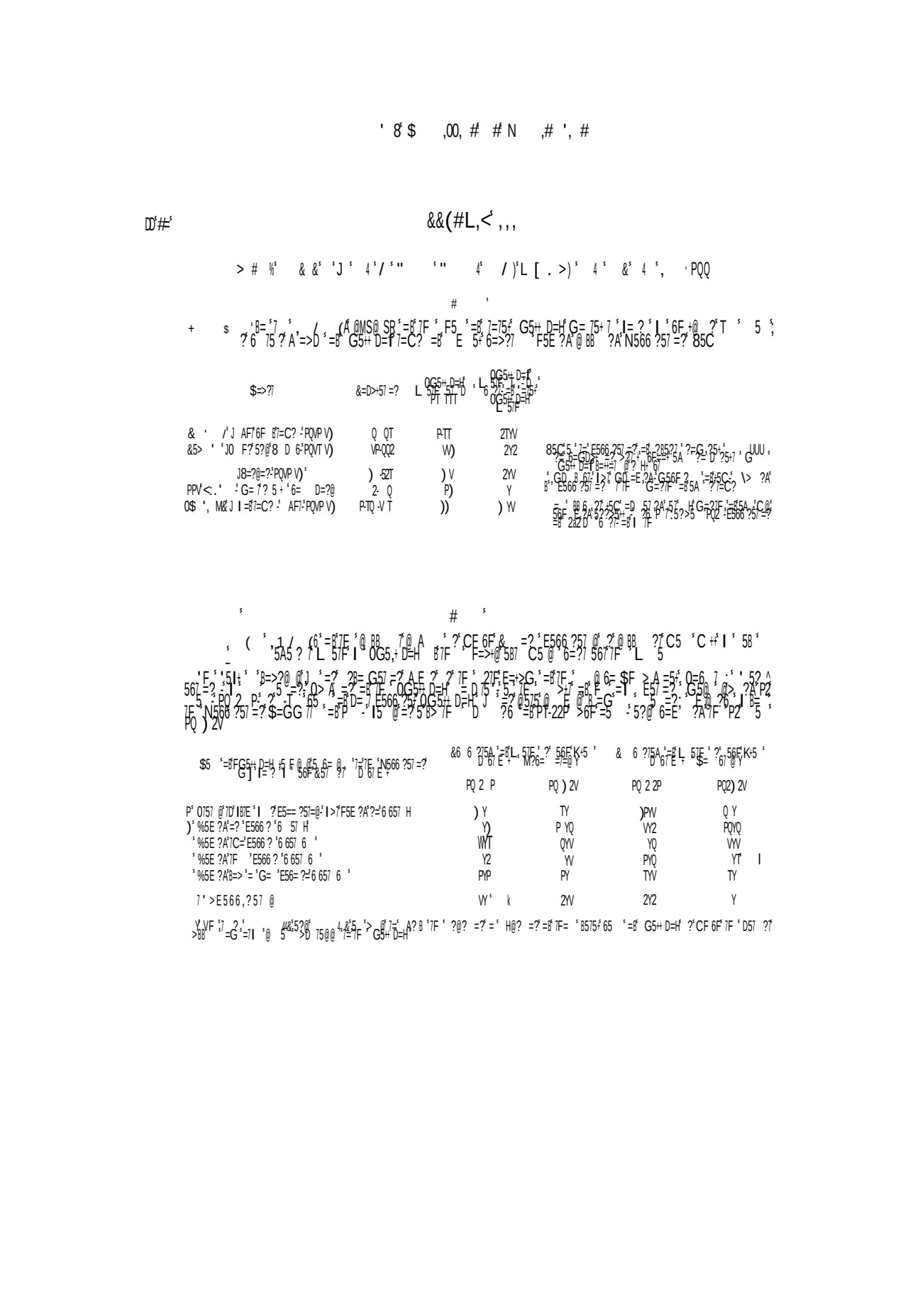
'C ?7 '+5 A '(% ' '=C?

	PQ T	PQVP	' PQVQ'	PQ	G7 - PQVT V	PQVT	PQVP	PQV)	PQV	&=> PQVT V -
8=?@=?	70	V-QV2	VQP	PP	PT-V T	; T	))	T	; 0	T 0)
AF7=?	T	T			PTQ	T	TYVP	T T		T;QT
& 7 >+=>7F' _	P	QS	TQ	Q	2 2	T B7	T Q	a)		P; T
#= C 6F		□G	PV'	P	2	V	YT	Q *	+	P V
&+ G=>7F		0Q	)TQ	)	)2Q		T Q	YT	TYT	T; V
7=+		2	)9		22	TYT)	T;)Q	P;PQ	TYT	TY 2
* =+E F5GD7=?		)Q	PQT'	)	22		;P2	) ;2+	T T	P;VT
G ?A15?+' _		2P	) Q	P))	Q	; +'	T;PQ	' TYQ	T Q	TY
8 6 7	&	PP	PQ		)2	'	T;P)	)T	TYT)	TYQ
#=77 ?AF5G' Y	'	P	)T	&			P;2Q	)Y)V		AcV
8 E D==+	PV	P- P	C	+5	CG	T;Q2	;Q	;: '	T;T)	P;T
7> F 7 ' _	0	)2V	V	W	P	T P	TYV2	TY))	TYT2	T T
05+B= @	Q	)QV	P		T2	TY)	PYQP	T	TaT	T;2P
+@F5G		)	)2		PT2	T;	T 2	TY T	; +	TY)
5@B= @	@		)		2V	TYT2	T;TQ	Ta)+	T;P	;M
8 @ '	' _		)2Q	M)	□G	TYT	T;PV	, *	Y P	' TY P
0F 7 +@' ' _	V	T2	2TP		P TP	; Q	P;2	)Y 2	T;T)	P;T2
%>++' ' '	P	QV	)+2		GH	+	TY V	N VQ'		a @
0>?@ +5?@	P	0T	'	P	T2	TYTP'	QY2	TY	; +	);QT
# C6C7+= =? ' 5 ' _	2	2	GC		Q T	0	; P	P T	; 07	PY2

' !

" 'B =G' \P'5?@' + (! P

[	0G5+D=e	$F6] ? SH	[	0G5++DDH	$F6] ? D=H
P Q	:2)2		P	-QTP	VQ
PQ	-PQP		PQ2	V)	2T
P T			PQ2	2 2P	T
PQ P	2- TQ		M;U	)- VV	2)
PQ)	)-VP		PQ2V	0 2V	2
PQ			,7H0	P-	Q
PQ			PQ2 ' -	P- Q)' -	QQ
PQ 2			PQVT	) V	V
P2 2			PQVP	) -T2)	
PQ V	-))V		PQV)' -	P -T))' Y	V)
PQ Q	2 TT		76G	) T0	2P
	3,g?		PQV	)-TQ	-
,Q2T	-22		PQV2	Q2P	PTP
PQ P	2 V		PQV2	)- T	PTT
PQ)	' V-)T		Y B	-)Q	,&
' PQ	P P		PQVQ	P-Q2	
PQ	)-QTQ		PQV	)	Q
PQ0	)- V	P	P T	2 P	7=
PQ T	)-)))		PQQP	T Q	P
PQ V	Q 0	'	PQQ	G 6	G '
' WPQ Q	2)T	T	PQQ	2V	
,Q2T		Q	PQQ	)-)	P
PQ2T	)-VPQ	2	PQQ	) Q)V	PT
PQ2P	P) T	T	PQQ2	S +	
PQ2)	V	'	PQQV'	2T2	QV



Q

(#K8 #L' #L' * 8(0

' F=C ?' 8=' 5=F' =' 7F' F H5' A 7 57 =?
L E ' =? 5?@' 5?7 6 @ ?7= 7E ' (D @ ' G 6 =' PQVP:@ 6+ ?'
?' 0G D=F ' =' 75+ 7 ' 5G=?A 7F ' ?85?7' &=D>+5^
7 =? 5?@@ @+ ?' =' 75[' 7 ' =' 0G ' ' D=H ' 7
5G=?A &=DH 7 =? '5I=E ',?85?6

3 '=' L ' . ' PT- T ' - P' '
O575+ 7 ' D ' J0 ?7 =' 7756]

_@ 7 P' O65 '=' ' O65 '=' G= ' O65 N566 ?57 =?
K=2@ ,GD $ 4 K==@ ,GD B 7 K==@ ,GD B 67 ^ ?5+Y

L E =?	& =@	T	2n					
8=?@=?' ' '	PQ P 2T PQ2P VT'	,0 PP2	P P	22Y T	TT PVYT	TYT	PPYP	TYT	2\2	YQ
0=>7F W 7 G' Y' S	PQ P 2T PQ2P VT	22	Q V	Q ;7	2PT PT P	)Y2 P	VY YQ	PYT QY	Y)YP	TYT 2Y	N TY	P YQ P Y
0=>7F'G @+5?@' '	PQ P 2I PQ2P VT	2Q	V	7&7) P	PT P P2)T	P)YQ	YQ QT	PYP)YQ	YP 2Y	TYT TY	PYT PY)	P Y2 P YT
(5 7 ?' ' ' 6	PQ P 2T PQ2P VT PQ2P 2T)Q2P VT	V)V V	2	YQ TV	)T QT QT T	YQ QT	7 Q	)YQ PPY	2VV	VYT	LO+	
* 7 +@+ +@' ' _	@ML@ ;U PQ2P VT	B) 2	PT V	QYT	T,	PY	P Y2	PQYT	PQYV	TYT	PYQ	Q Y
#= 7F'G @+5?@' ' -	PQ P 2T PQ2P VT	2Q	2									
#= 7F C 7 ?' ' _ -	PQ2P 2T PQ2P VT	PPQ 2)	W									
!=]' ' ' P	PQ2P 2T PQ2P VT	PP2 PTV	O *									
#= 7F ?' Y ' -	PQ P 2T PQ2P VT	PPV VQ	PT C									
*ß' ' '	PQ2P 2T PQ2P VT	P2	PV									

' " DD' #=' 0

#=7 N566 ?57 @ 7' A 2==@ ,GD B 67 N566 ?57 =? #=G ?5+Y

22Y'	T 2	TYT	PPY2	Q YQ
Y)	2 PT	Y TY	2YT	P YQ
) Y	PT P	_PYP	QY	P ;2
)YP	P)T	PY	2Y	P YT
YQ	QJ&QT	QY	P YP	Q)YP
TYV	QT T	Y2	_P YQ	Q Y
YT	Tn	PY)2	P YP	QQY

Y #=G ?5+1' 5 @7=' F5E ' I ?' N566 ?57 @+ I >7 ?=' G5] ' E I+

" ! 8 $ +00+ # # N $$,# ', #

DD =Q' # ' ,

(#K8 #L' #L' * 8(0

66 H' F=I ?A' B=' 56F' =' 7F ' 9 F ?' A 7 57 =?'
L F ?' ?' 52@' @> ?A' >69 ?6 ' 6W >' = 'N566 ?57 =?' 52@'
@> ?A' 6=GD+ 7 ' 5G=?A' 7F ' ?B5?7 &=D>57' =?' 5G= 7F '
B ?@ 57 =?' =' OG5M D= = 7 5G= 7F '
&=D>57 =?' 5I=E ,?B5?6

L 5?F 57 ??>5' OG 5+ D=H' D PTT-TTT

PQ P 2T
PQ2P VT
PQVP QT

PQ P 2T PPV
PQ2P VT VQ
PQVP QT QV
PQ P QQ 2

PQ P *
PQ2P VT
PQVP QT

T 2 2n

PQ P 2T PQT PQ
PQ2P VT PP2 P
PQVP QT PPQ Q
PQQP QQ QV P$

PQ P 2T 2 Q
PQ2P VT Q PV
PQVP QT)T PT
PQQP QQ PP 2

PQ2P 2T 2)
PQ2P VT Q V
PQVP QT)P PP
PQQP QQ 2

PQ P 2T V
PQ2P VT)V 2
PQVP QT)Q PV
PQQP QQ PQ PP

PQ2P 2T
PQ2%T ' V
PQVP 5)V PT
PQQP 2Q P P

PQ P QT P) PT
PQ2P VT 2P V
,Q + 2T)T
QQP QQ $

PQ2P QT _2 2
PQ2P VT T' P
PQVP QT O ' - P
PQQP QQ)

PQ P 2T PP
PQ2P VT J) Q
:QVP QT T PV
PQQP 2Q

O=>?F' @+5?@

Q=?7F-Y 7 ?

* 7 @+5?@' _

= 7F' @+5?@

#= 7F C 7 ?

' -

8 #L #

' F=C ?A' 26 ' $=GD>+ = ' N566 ?57 =?' 52@'
@> ?A' ?' 6=GD+ 7 ?A= 6 ,G ?7- ?A' ?' 5?'
@ 6+ ?' ?' OG5+ D=H' = ?5+ 7 5G=?A' 7F ' ?B5?7'
&=D>=57 =?- 52@' 7F ' B=>6>57 =?' =' OG5+ D=H'
= 75+ 7 ' 5G=?A 7F ' &=D>+57 =?' 5I=E ,?B5?6

??>5' OG 5+ D=H' L 5?F 57 '
D PTT-TTT 5 7 56F' A
O F ' I- 5 '& =@ '
$= 'G = 7D 5 7

T 2 7

PQ Z' ' ')PO P
PQ V) P2
PQ T ' ' _ P2T ' P)' _
PQ 2 PTP ,+8
PQ2T 2 PP P
PQ22 2 PPQ
PQVT V P) 2
PQV V 2)1)
PQQT P P
PQQ QQ PT

> # %ˢ & &ˢ ˢJ ˢ ˢ[ˢ" H")ˢ /)ˢL [. > ˢ4 ˢBZ4 ˢ, ˢPQQ

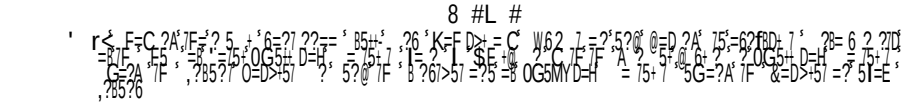
(#K, #Lˢ #Lˢ * 8(0

ˢ F=C ?Aˢ B=ˢ 56Fˢ =Bˢ7Fˢ 5+ˢ" B 7 57 =?ˢ L = ˢ5?@ˢ@> ?Aˢ >66 Eˢ@ 6 ?? 5+ˢ7Fˢ ==?7 G=>Aˢ
B5++ˢ 26ˢ =G ˢ>ˢ= N566 257 =?ˢ5?@ˢ@> ?Aˢ 7 6=GD+ 7 ˢ?B= 6 G ?7 =Bˢ+Fˢ 5 ˢ=Bˢ =75+ˢ0D 5++ D=Hˢ
= 75+ˢ7 ˢI= ?ˢ I ˢ$E +@ ˢ?ˢ C 7Fˢ7Fˢ A ?ˢ 5+ˢ@ 6+ ?ˢ ?0G5++ D=Hˢ = 75+ˢ7 ˢ5G=?Aˢ7Fˢ ,?B5?7 &=D>+57 =?ˢ
5?@ˢ7Fˢ B+>67>57 =? =Bˢ0G5++ D=Hˢ = 7 7 ˢ5G=?Aˢ7Fˢ &=D>+57 =?ˢ 5I=Eˢ ,?+F?7

DD-. TQ

! "

8 #L #



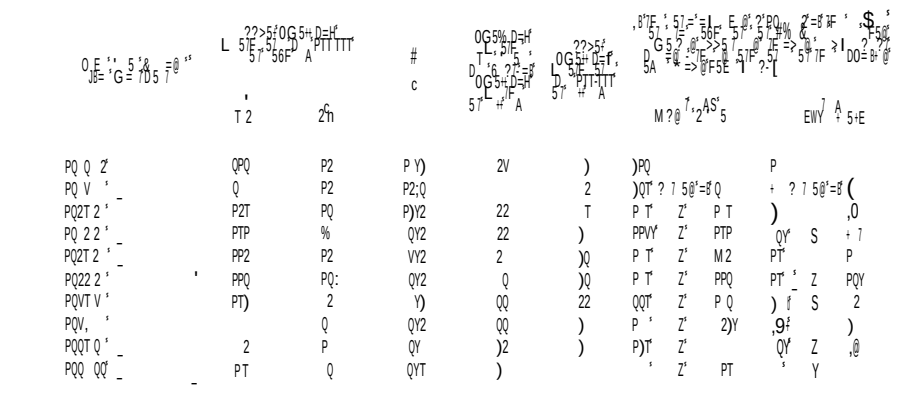


DIAGRAM *Handed in by Mr R. Thorne Thorne, M.D., F.R.C.P. on the 17th July 1883.*

DIAGRAM *Showing for England and Wales (a) the average annual death-rate per million living at all ages during the three decennia 1851–60, 1861–70, 1871–80, and during the seven years 1881–7 from Smallpox, Measles, Scarlet Fever, and Whooping Cough; (b) in each instance the share of the all age mortality borne by children under five years of age.*

N.B. *The heights of the several columns with the figures at the head signify the death-rates at all ages. The portions more deeply shaded, and the figures in these portions, indicate the share of children under five in the all age mortality.*

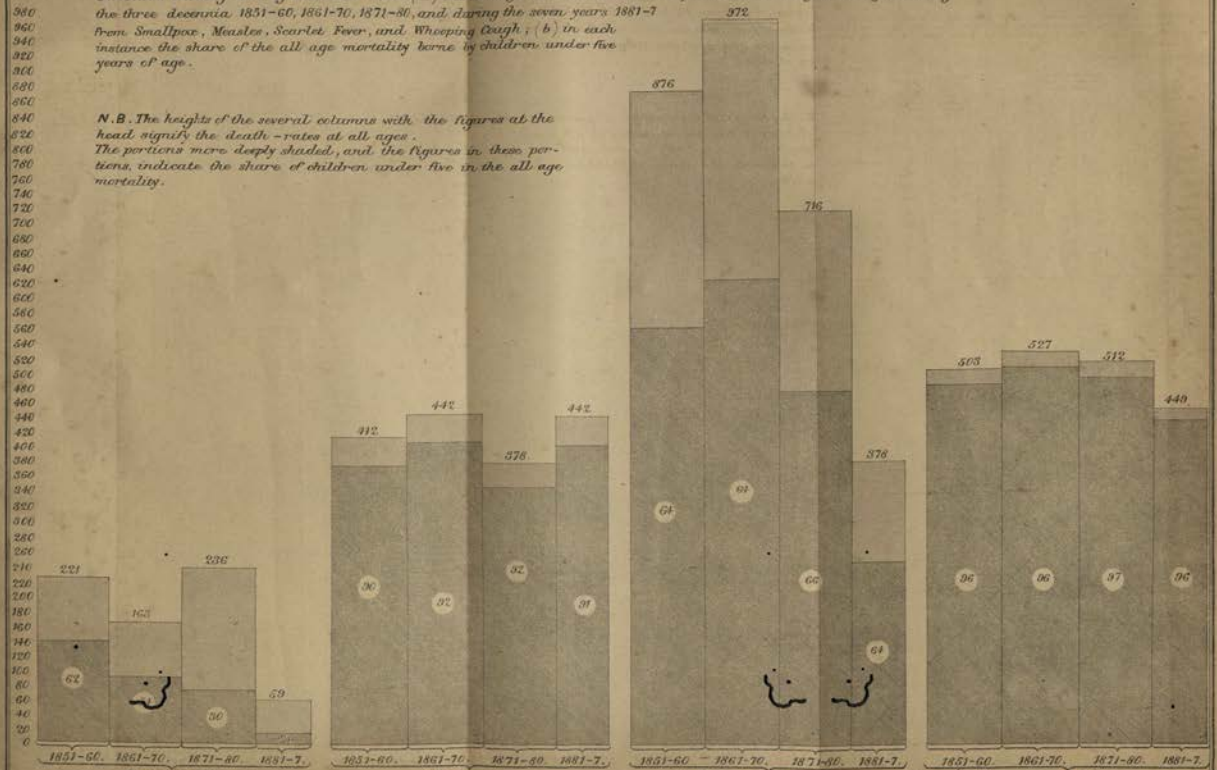
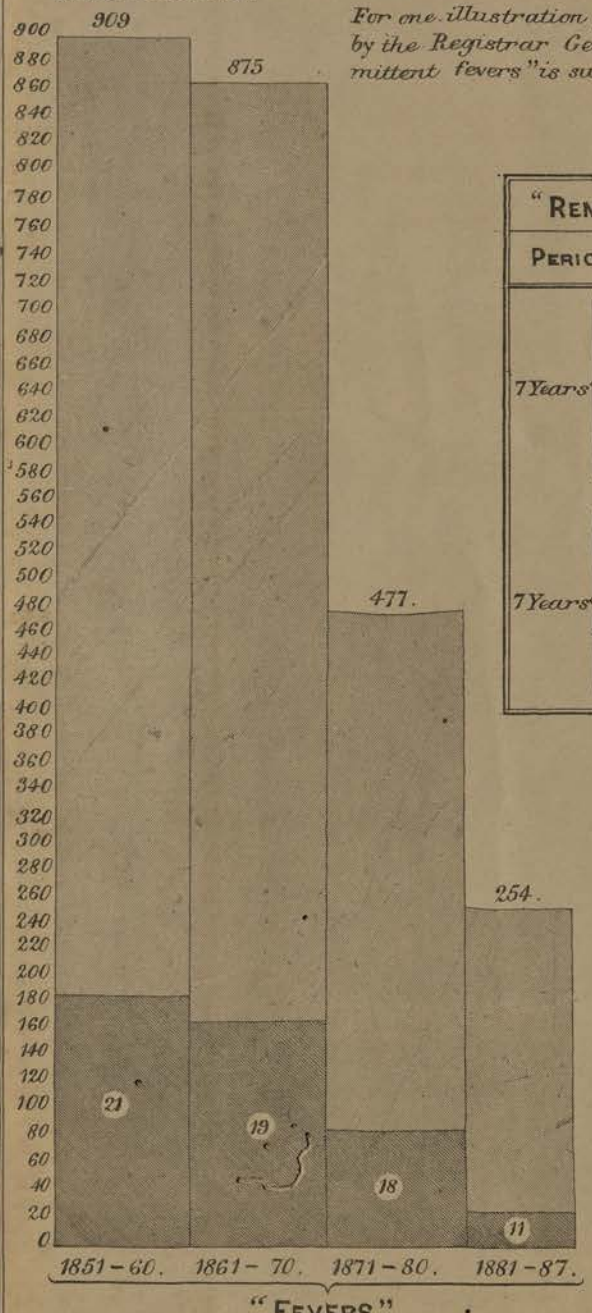


DIAGRAM *Handed in by Mr. Thorne Thorne, M.B., F.R.C.P., on the 24th July 1889.*

Rates of death from causes described as "Fevers," but which are presumably not the same class of causes in the several periods.
To accompany diagram relating to Small-pox, Measles, Scarlet Fever, and Whooping Cough; and to illustrate the fallacy of dealing with death-rates and shares of mortality, when the definition of "Fevers," as a group, is not constant.

For one illustration; - the actual mortality placed by the Registrar General to the account of "Remittent fevers" is subjoined.



"REMITTENT FEVER" DEATHS.

PERIOD.		AT ALL AGES.	AT AGES 0-5
7 Years	1874	79	—
	1875	70	1
	1876	48	—
	1877	81	—
	1878	90	—
	1879	82	—
	1880	76	—
7 Years	1881	239	154
	1882	246	152
	1883	194	132
	1884	177	109
	1885	138	87
	1886	127	72
	1887	93	59

The deaths at ages under five ("infantile remittent "fever") would appear to have been placed with enteric fever before 1881; since 1881, they have gone along with "remittent fever" at ages over 5 into the class of Malarial diseases.

87.

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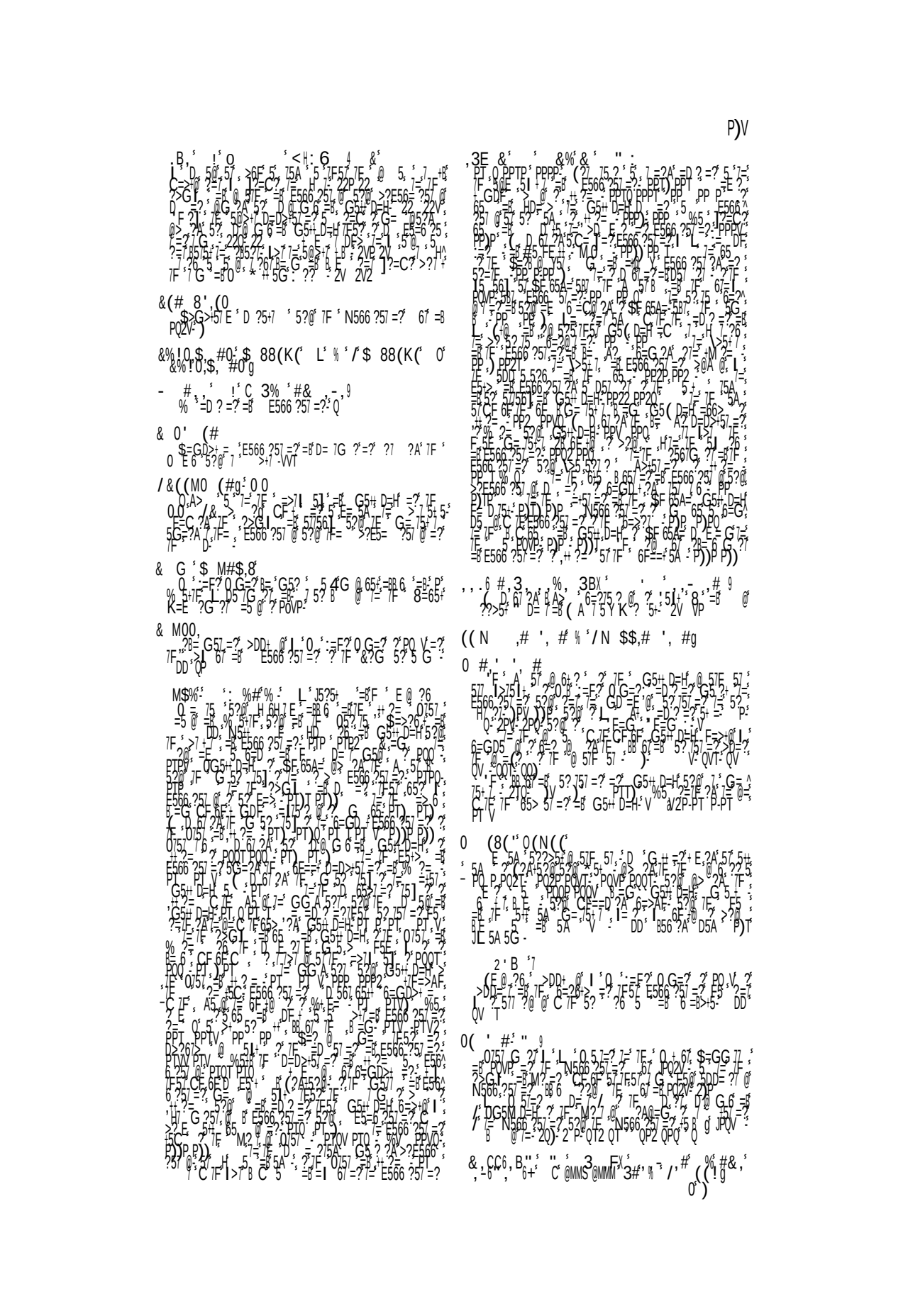
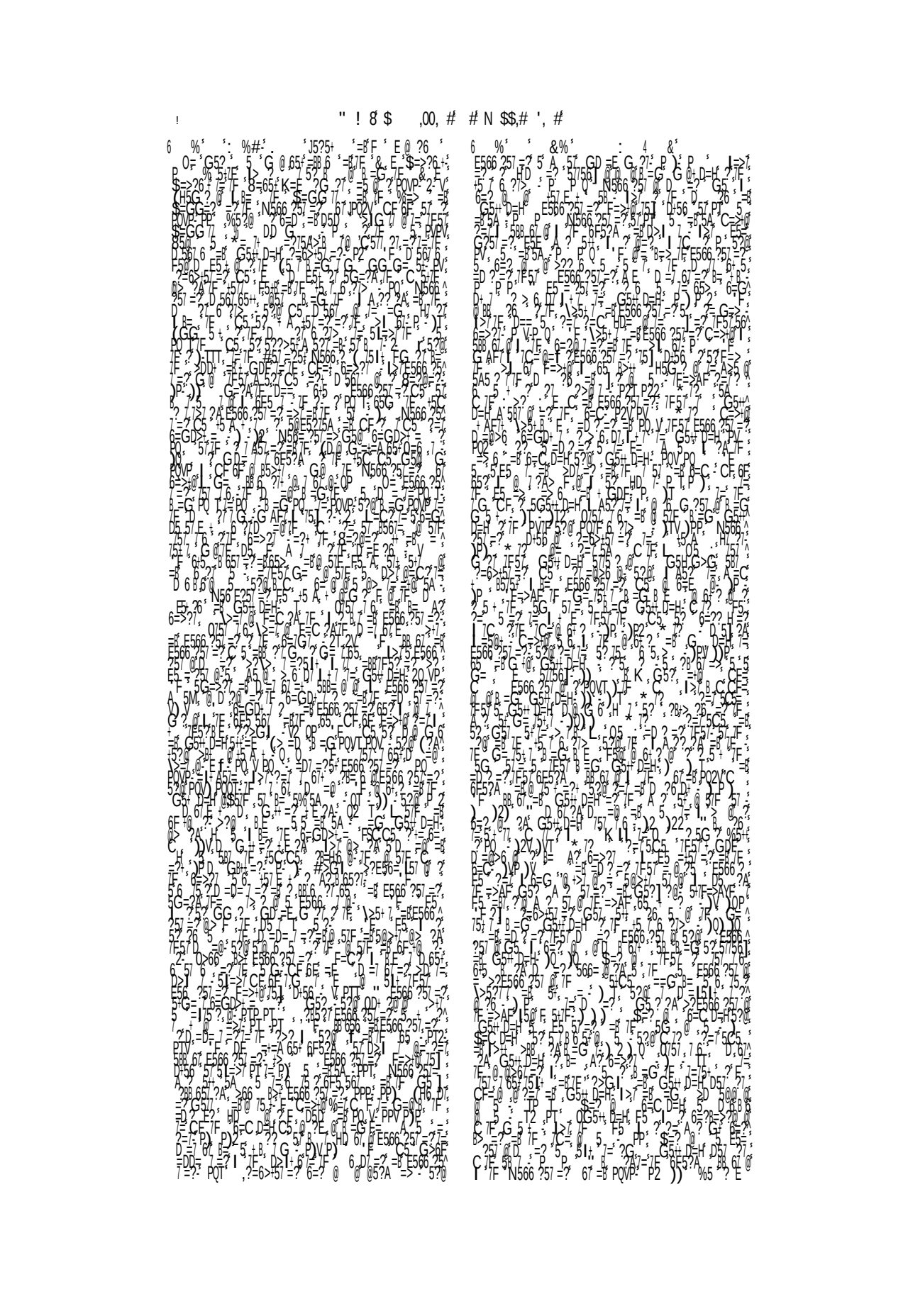
&& #L,<

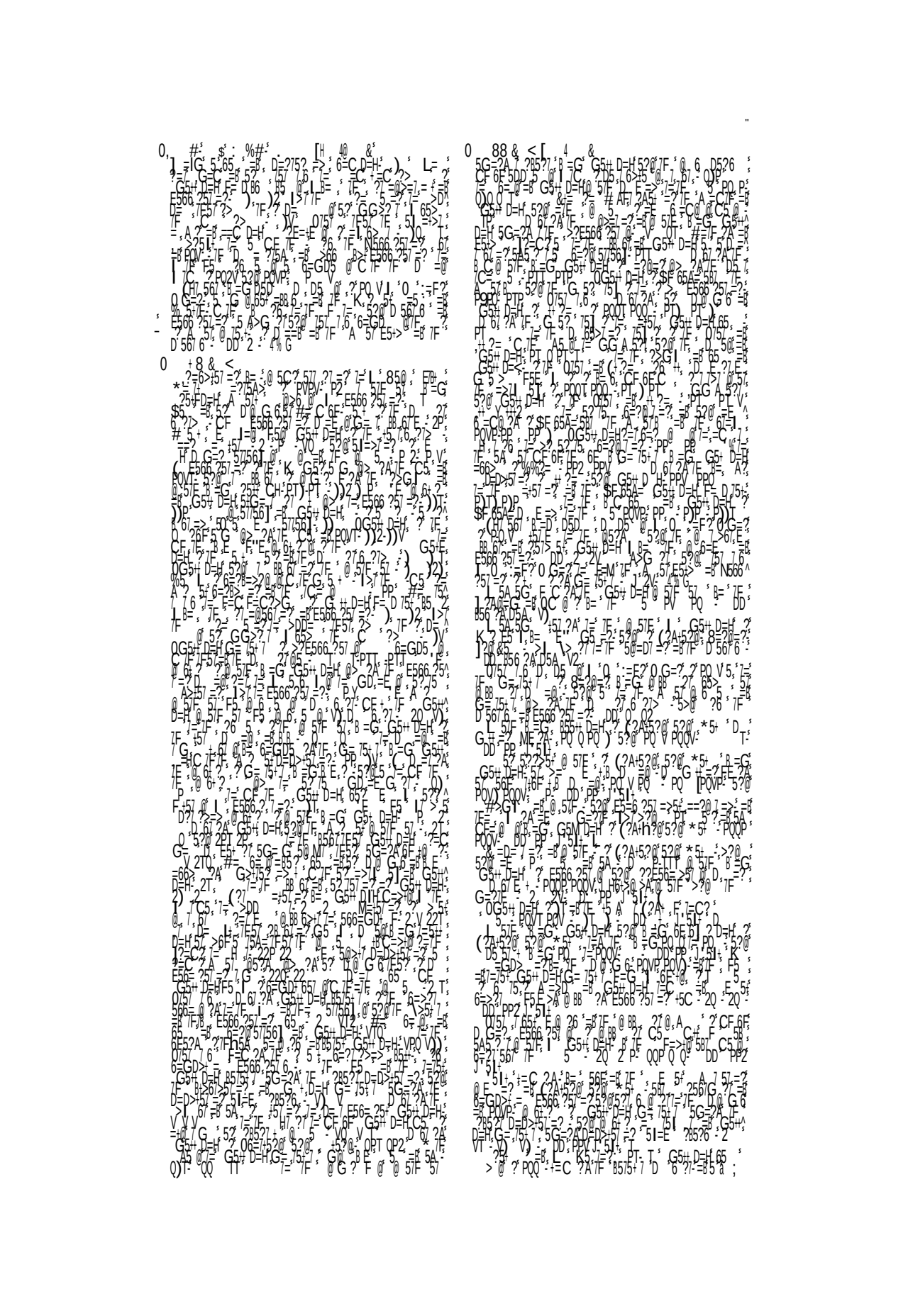
88 / U 5

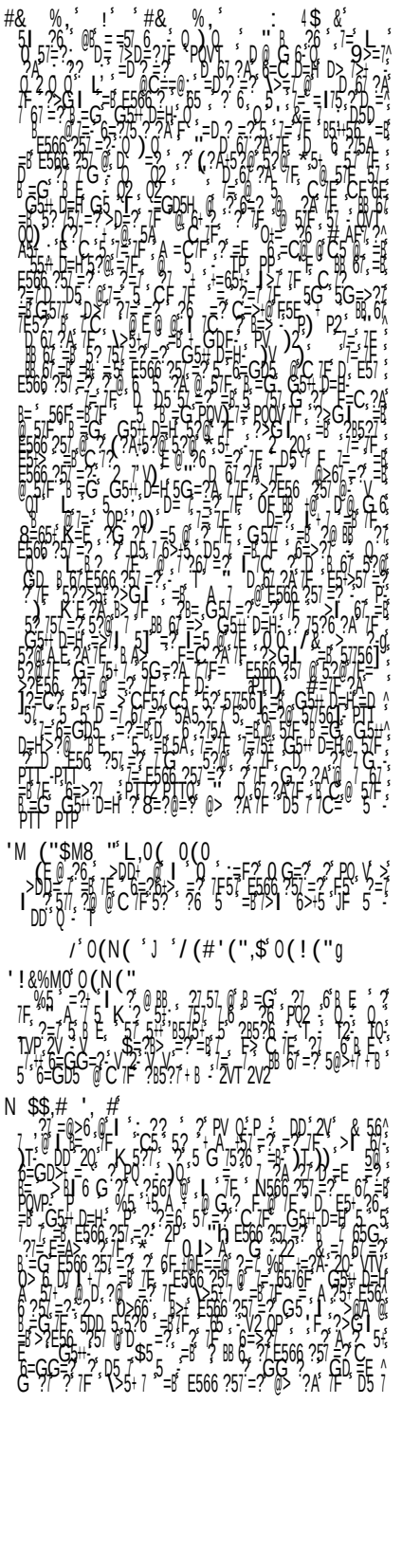
0' '((#' 0% * #K- 0 . ($% ('%('("0 POV) ' POQV- '%(#M ("
0 %('%0 0" 0 88 & < #L '%(#M ("T GC ? 7 *
'(L ,# [
@ , * /
R , * / 3%/ 6 P('/ * $ =
D # $ - /
T , (+ ' , * / /

;L [. > ˢ ˢ4 ˢB]4Pˢ, ˢPQQ ˢ ⁇ 9? 0⁇ =>ˢ 2 T Q ˢ DDˢ#=S
=ᵝL 57I5ᵝB =Gˢ0G5ᴴ D=H-ᵝ5?@ˢ7Fˢ#?GI ˢ=ᵝ,?85?7ˢN566 ?57 @ˢ ? [
ˢ 3(ᴴˢ=ᵝ7Fˢˢˢ









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VACCINATION COMMISSION.

SECOND REPORT

OF THE

ROYAL COMMISSION

APPOINTED TO INQUIRE INTO THE SUBJECT OF

VACCINATION;

WITH

MINUTES OF EVIDENCE AND APPENDICES.

Presented to both Houses of Parliament by Command of Her Majesty.
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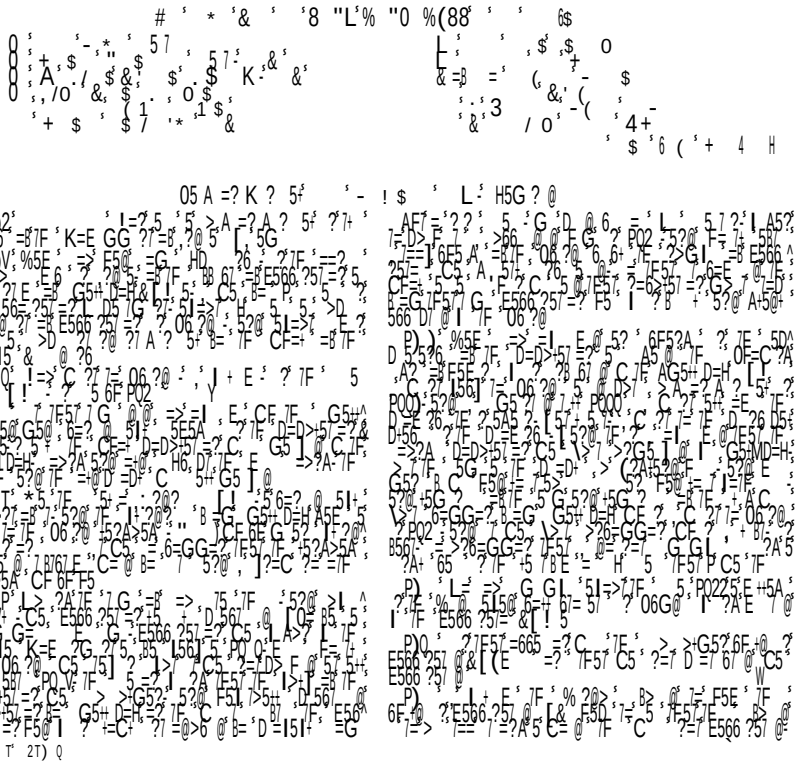

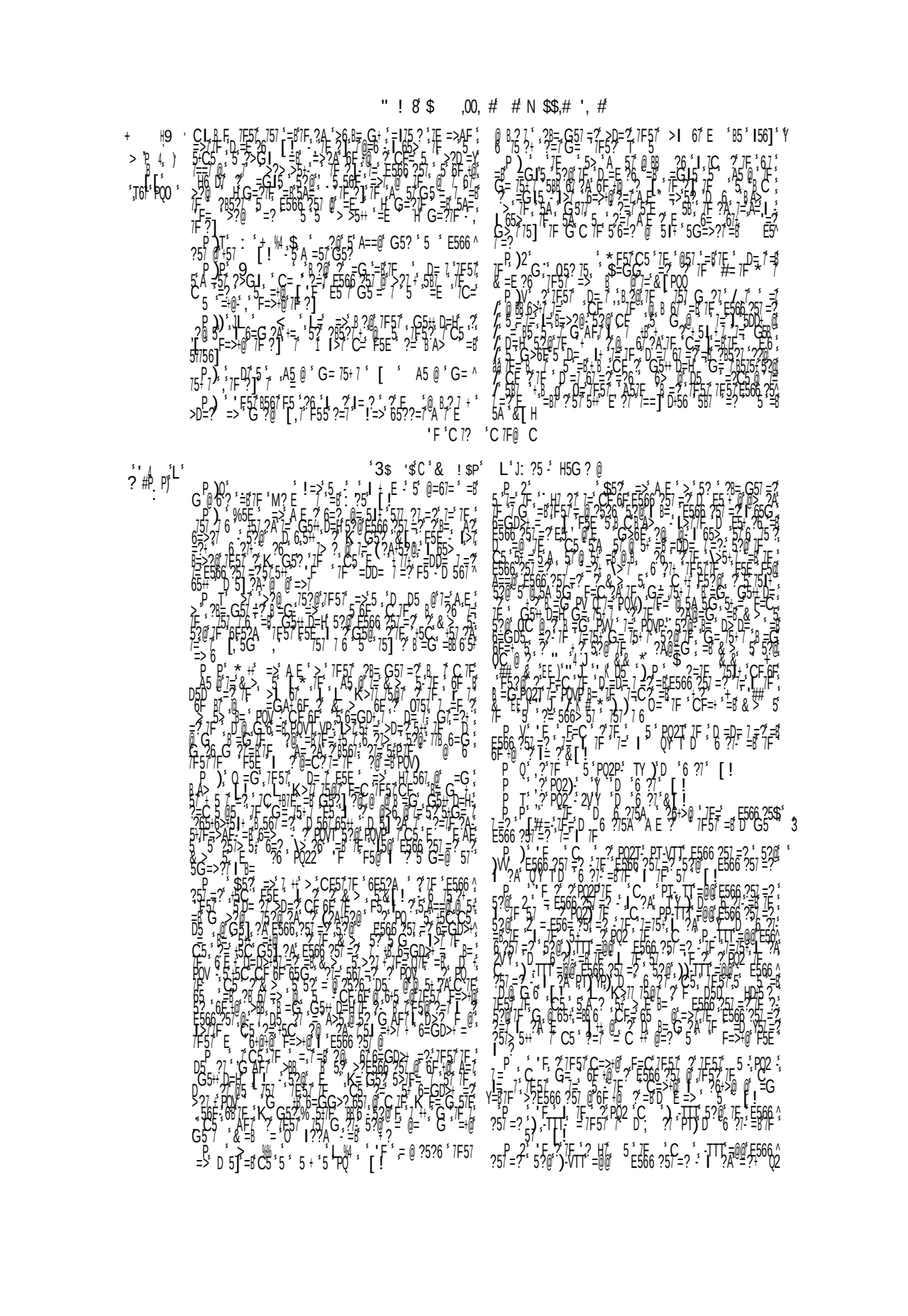

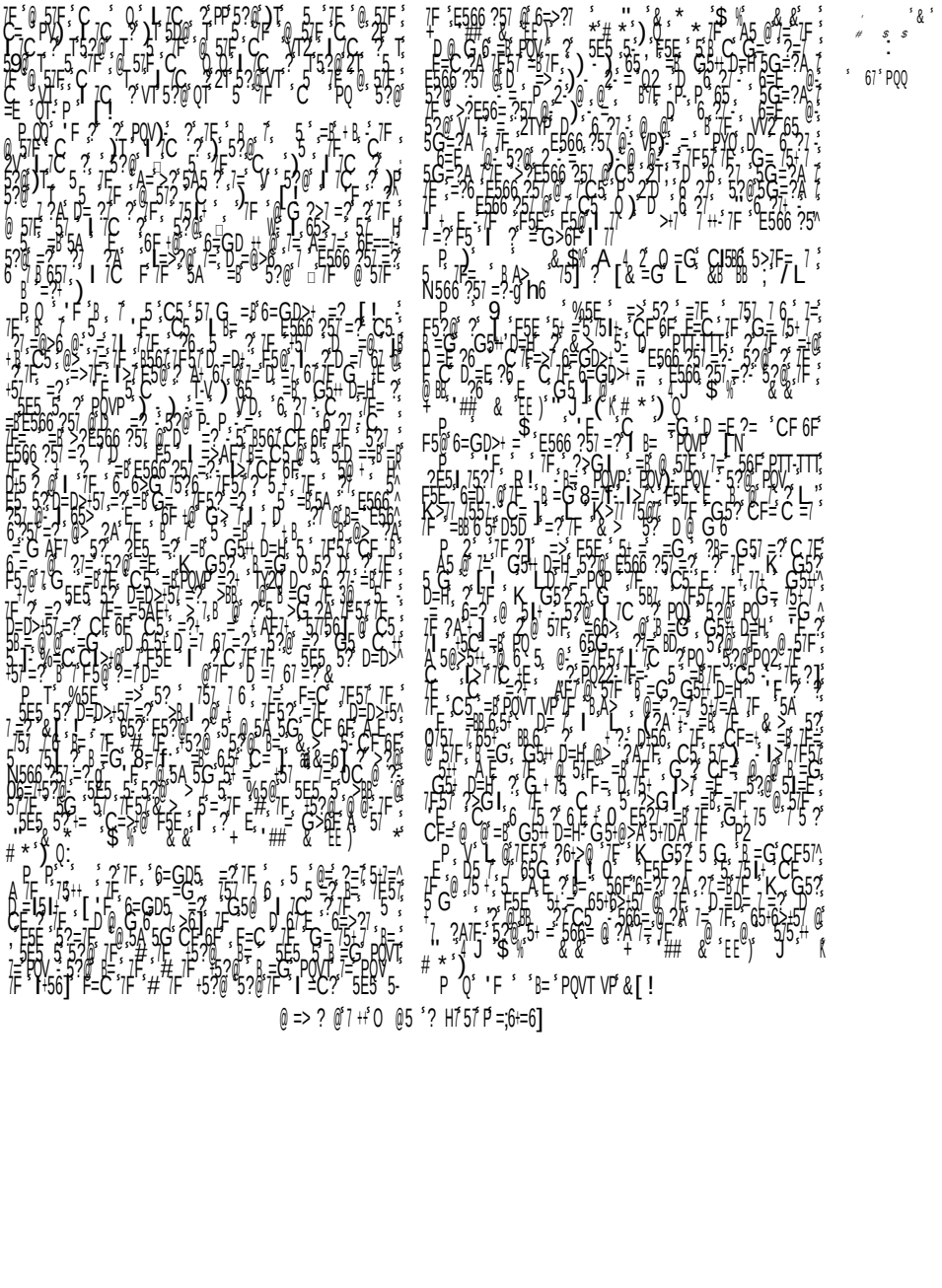

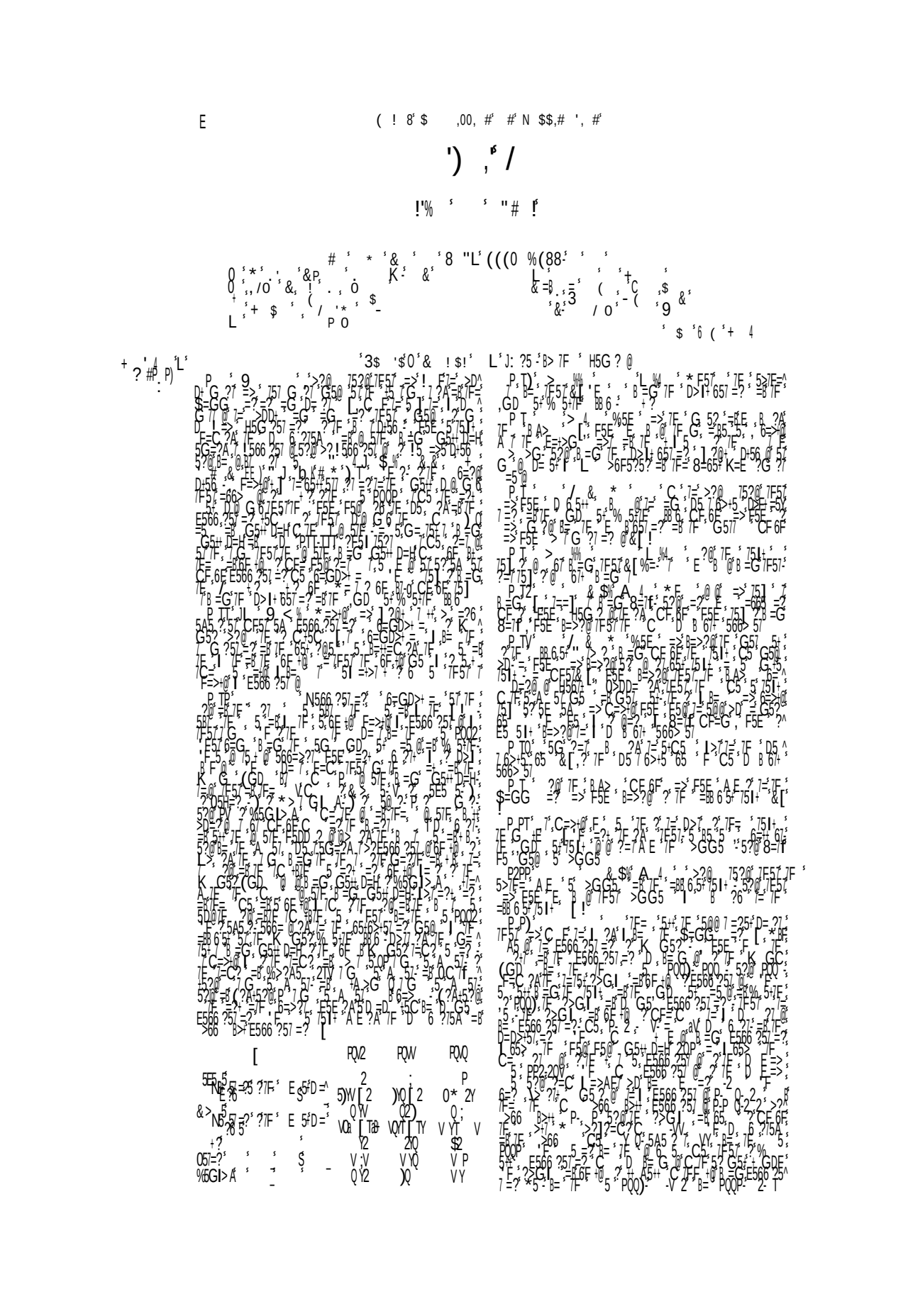

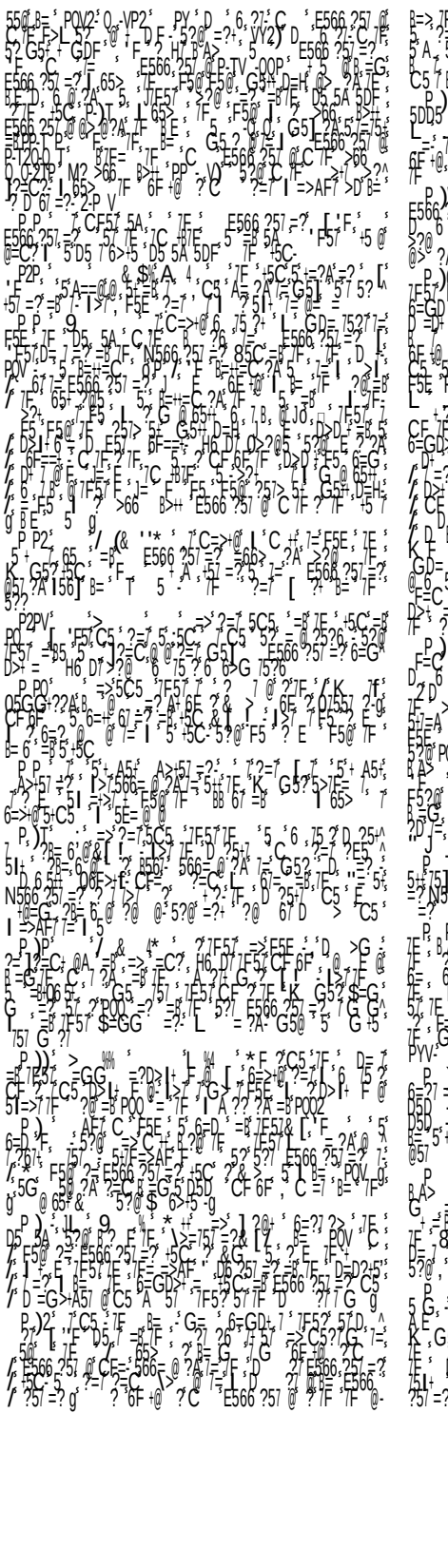

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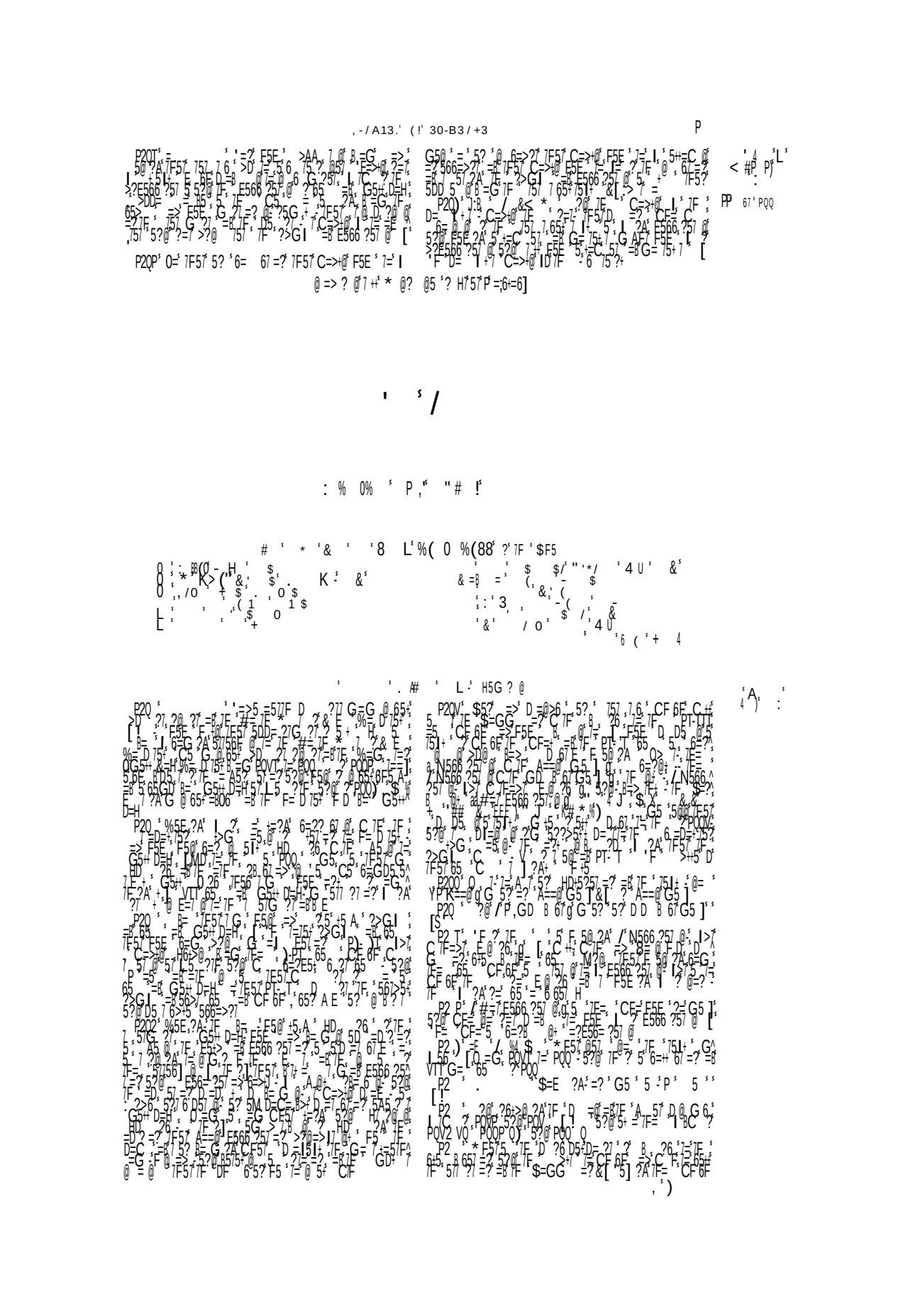

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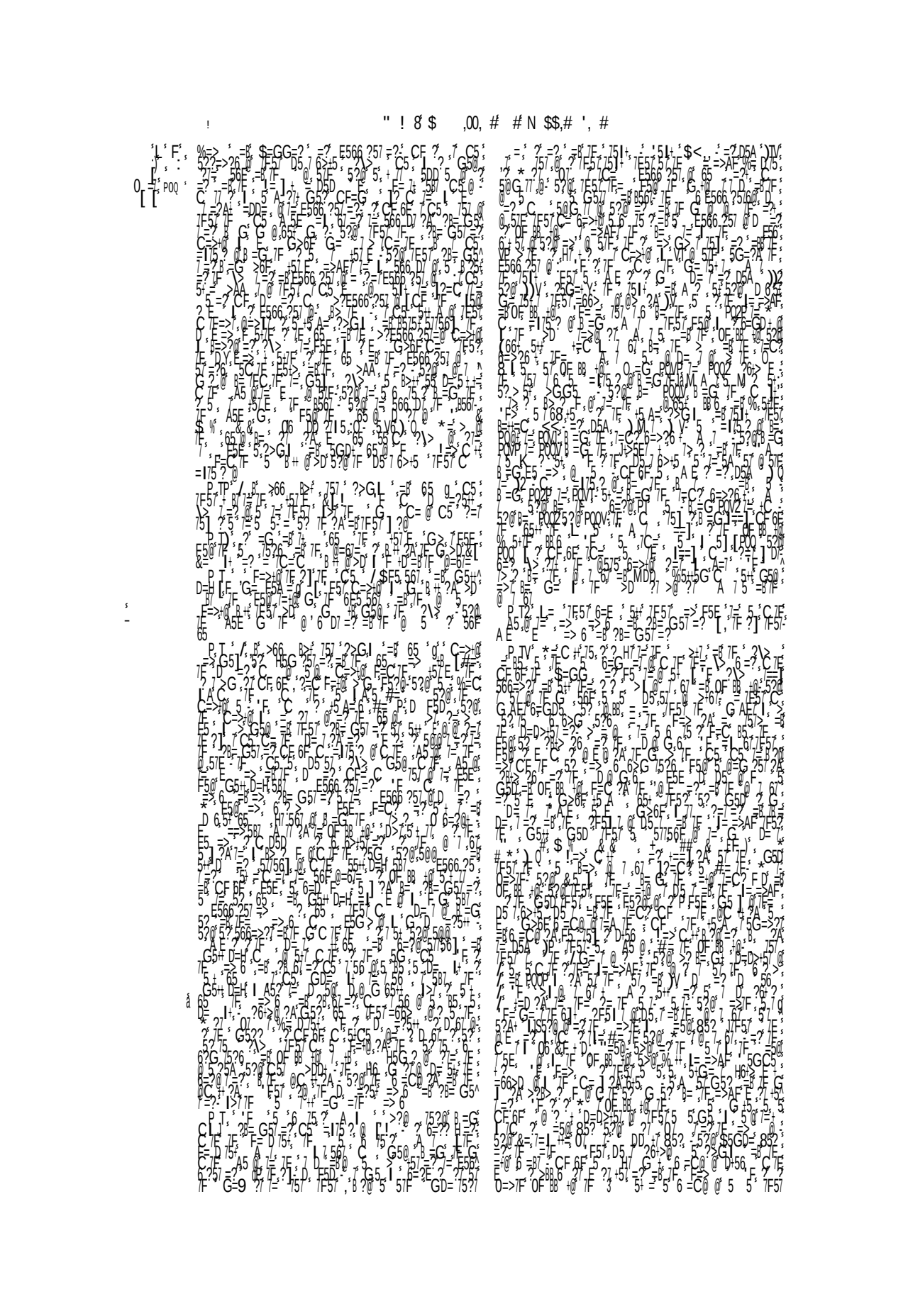

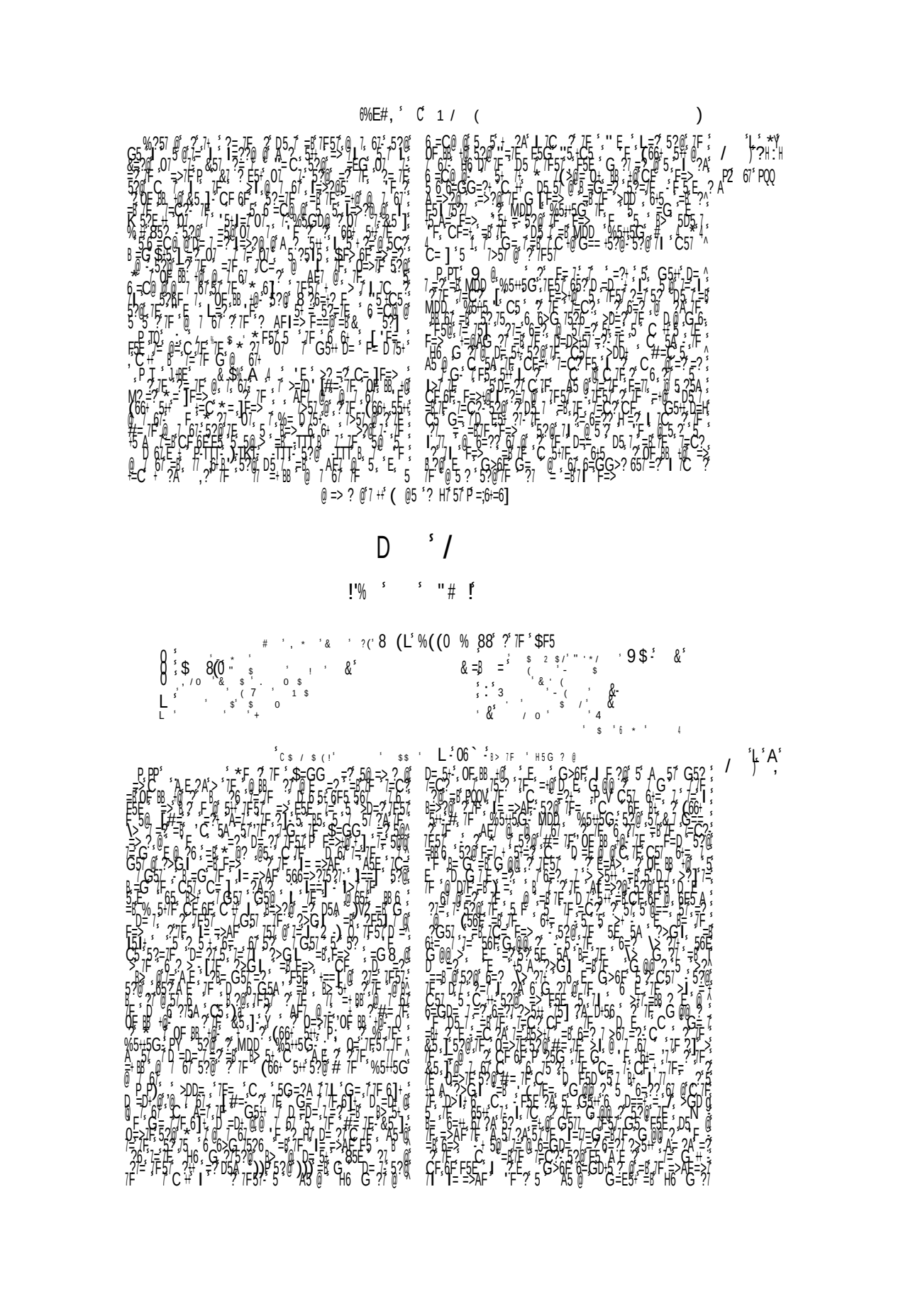

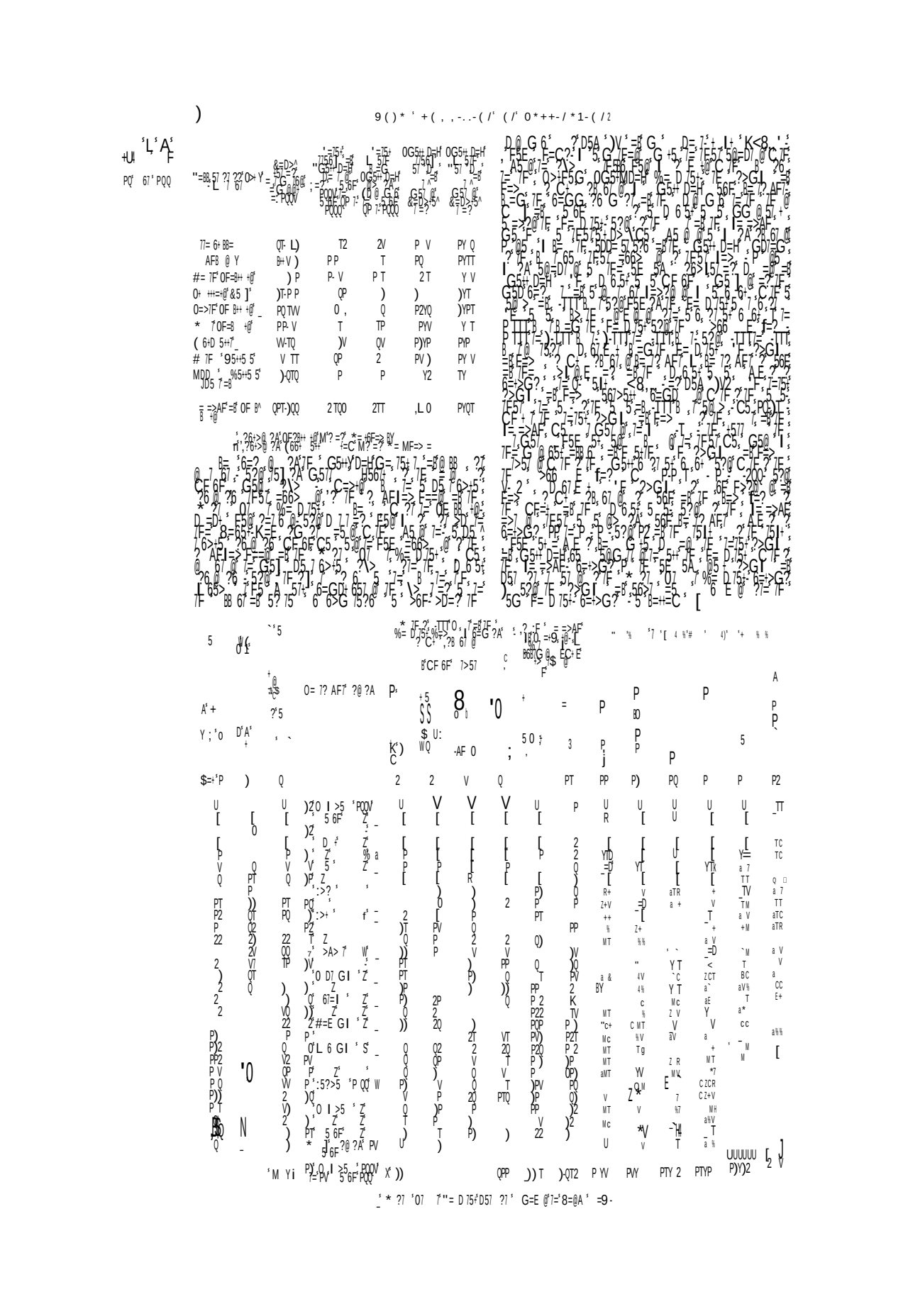

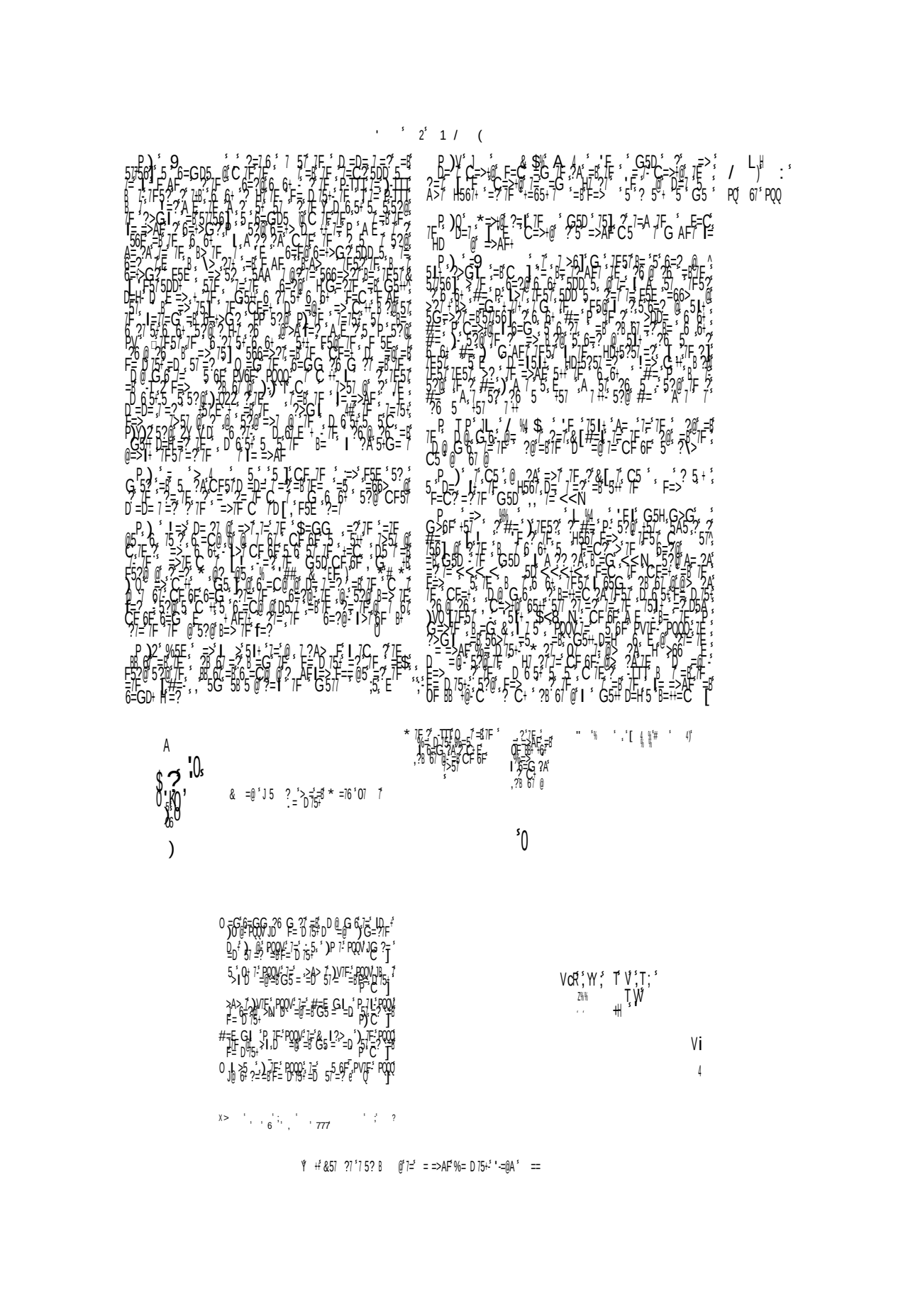

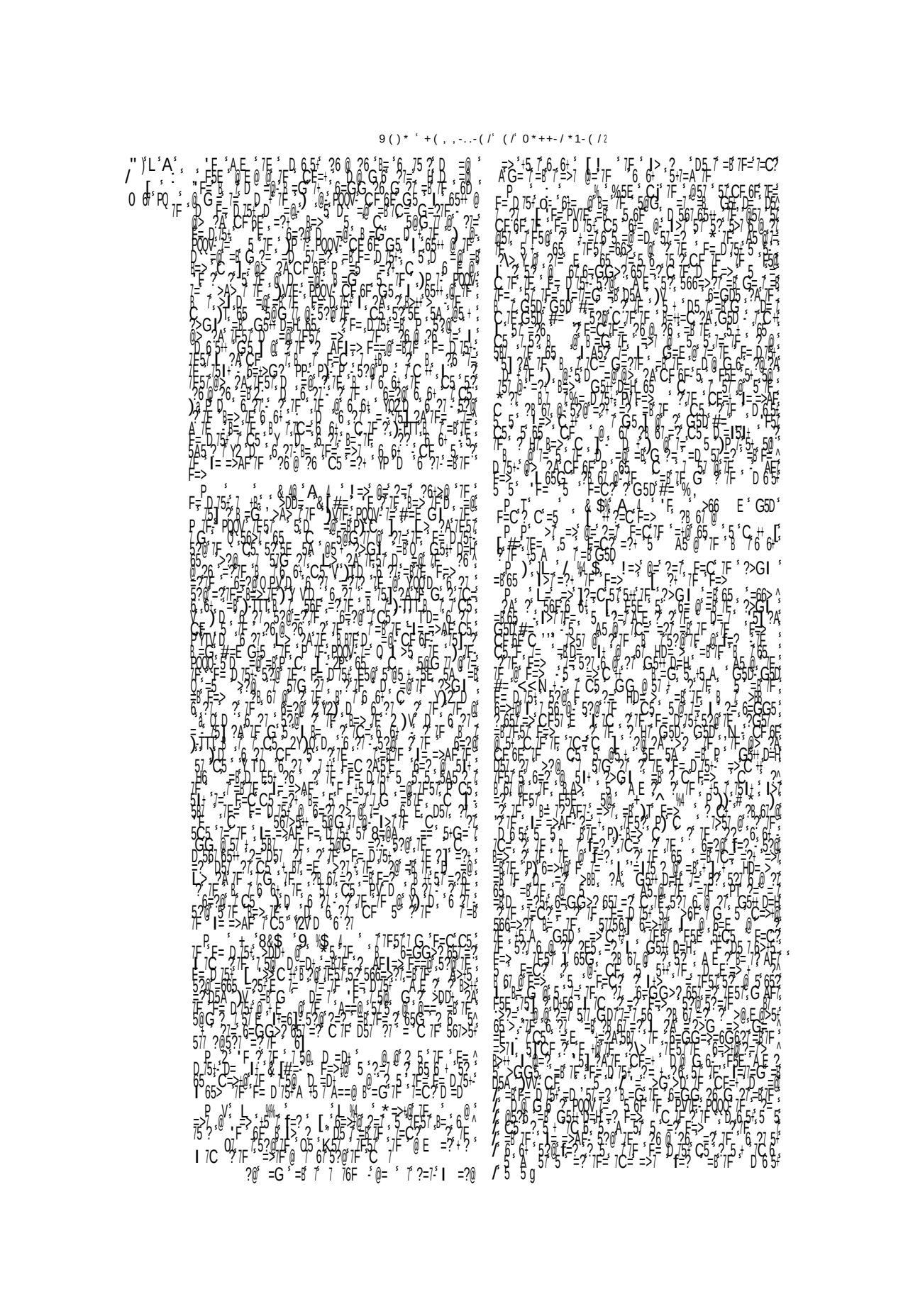

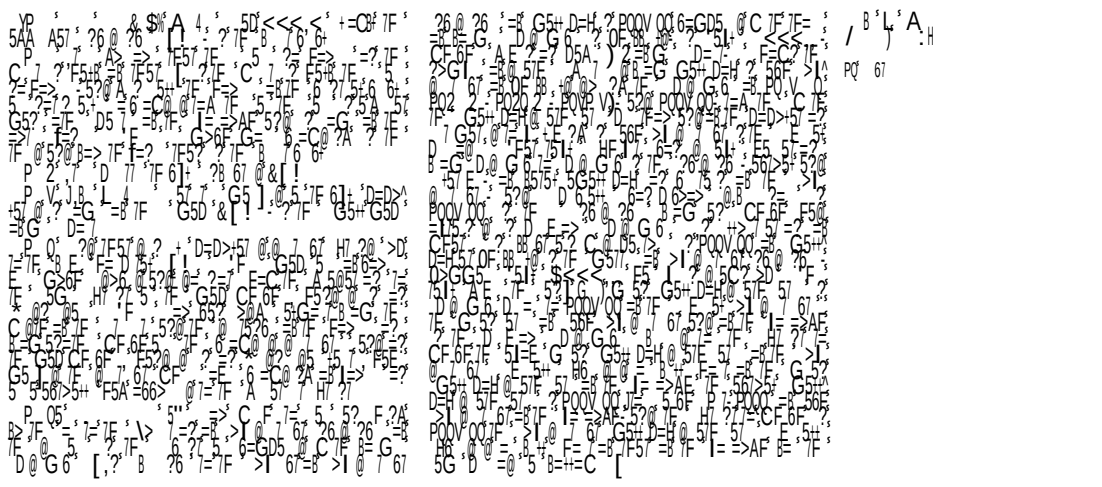

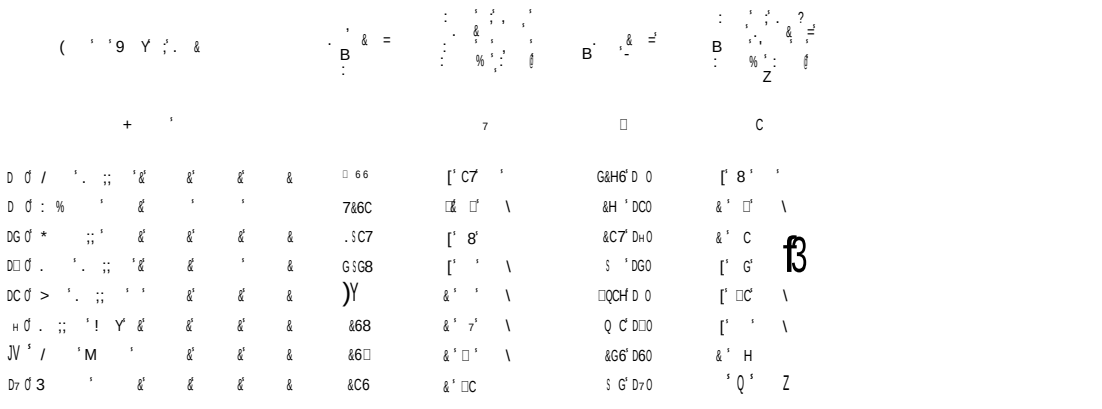

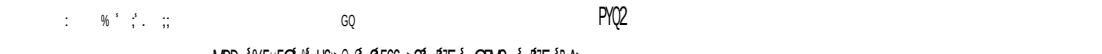

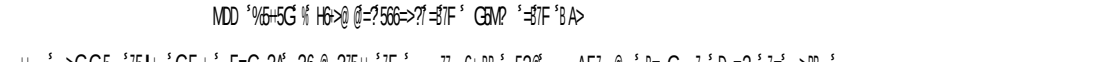

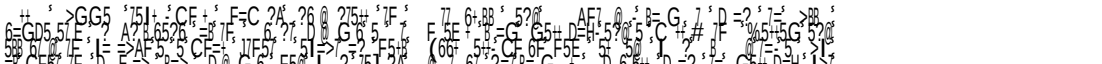

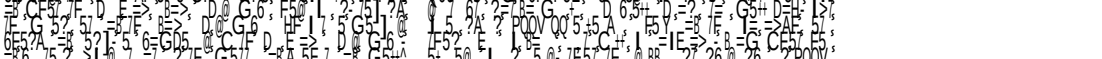

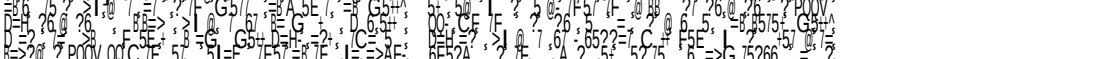

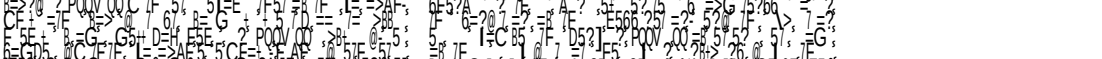

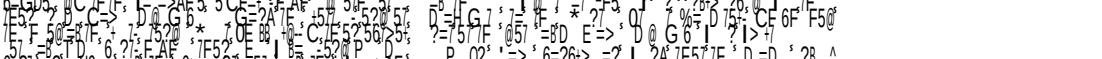

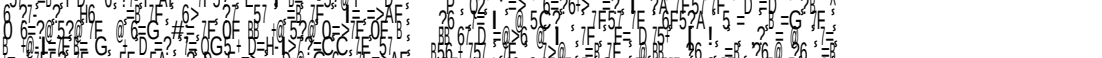

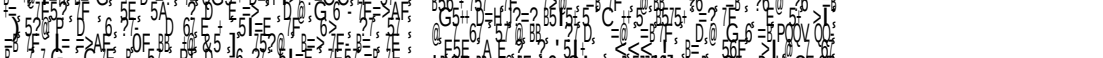

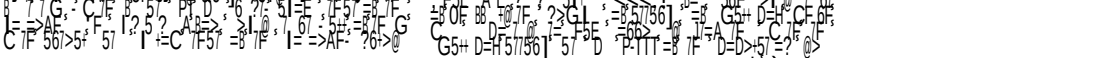

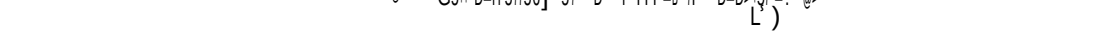

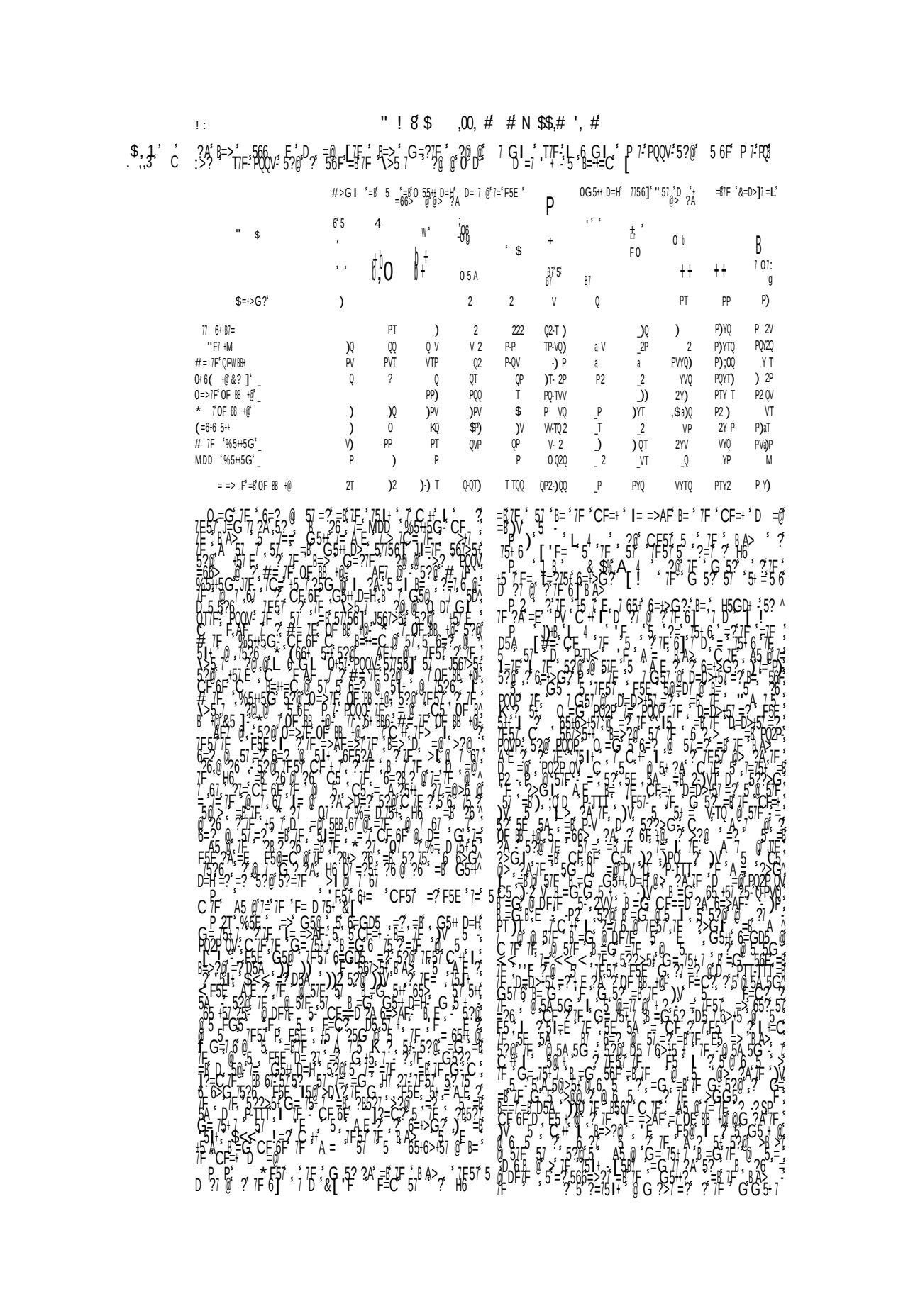

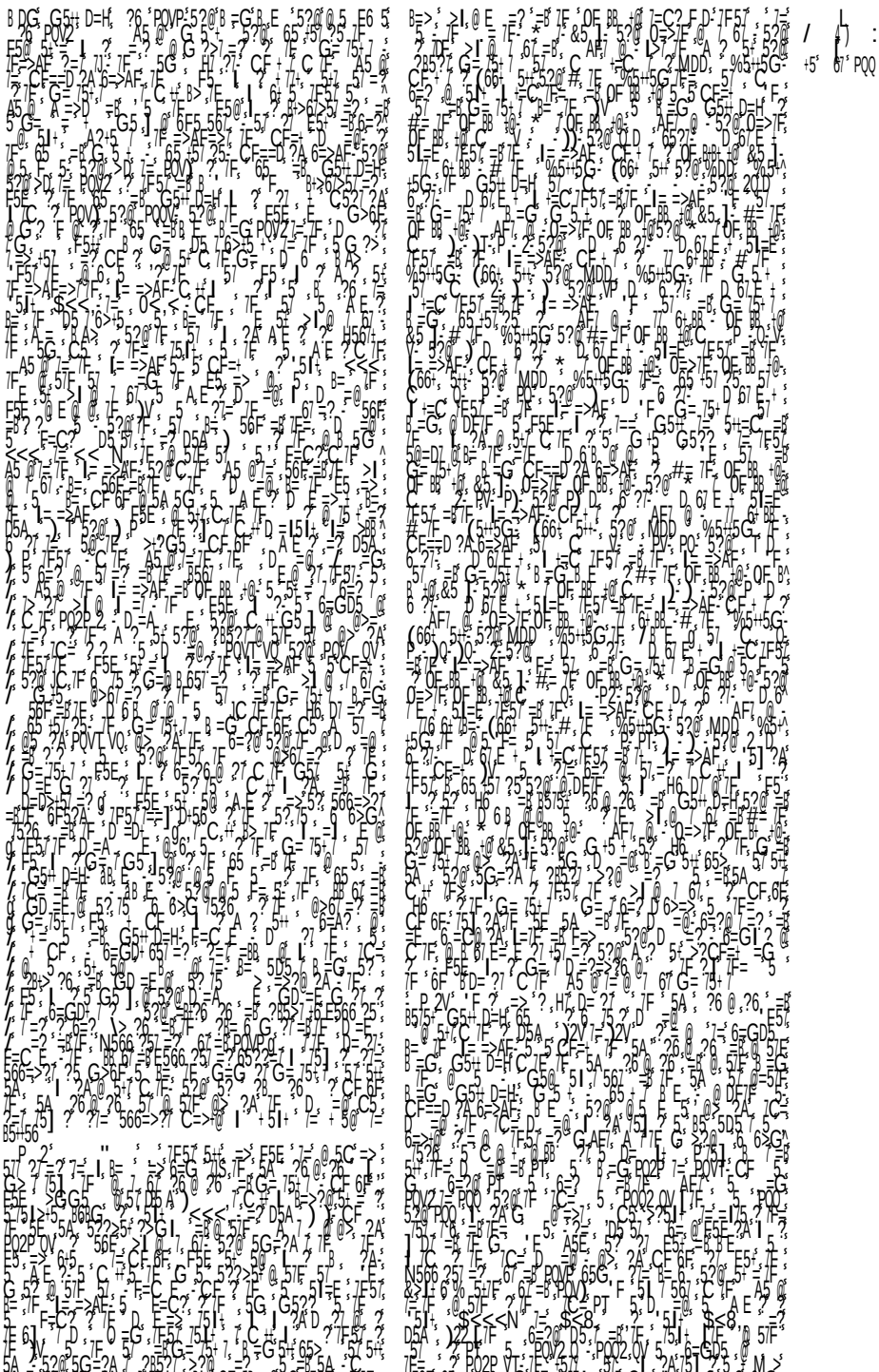

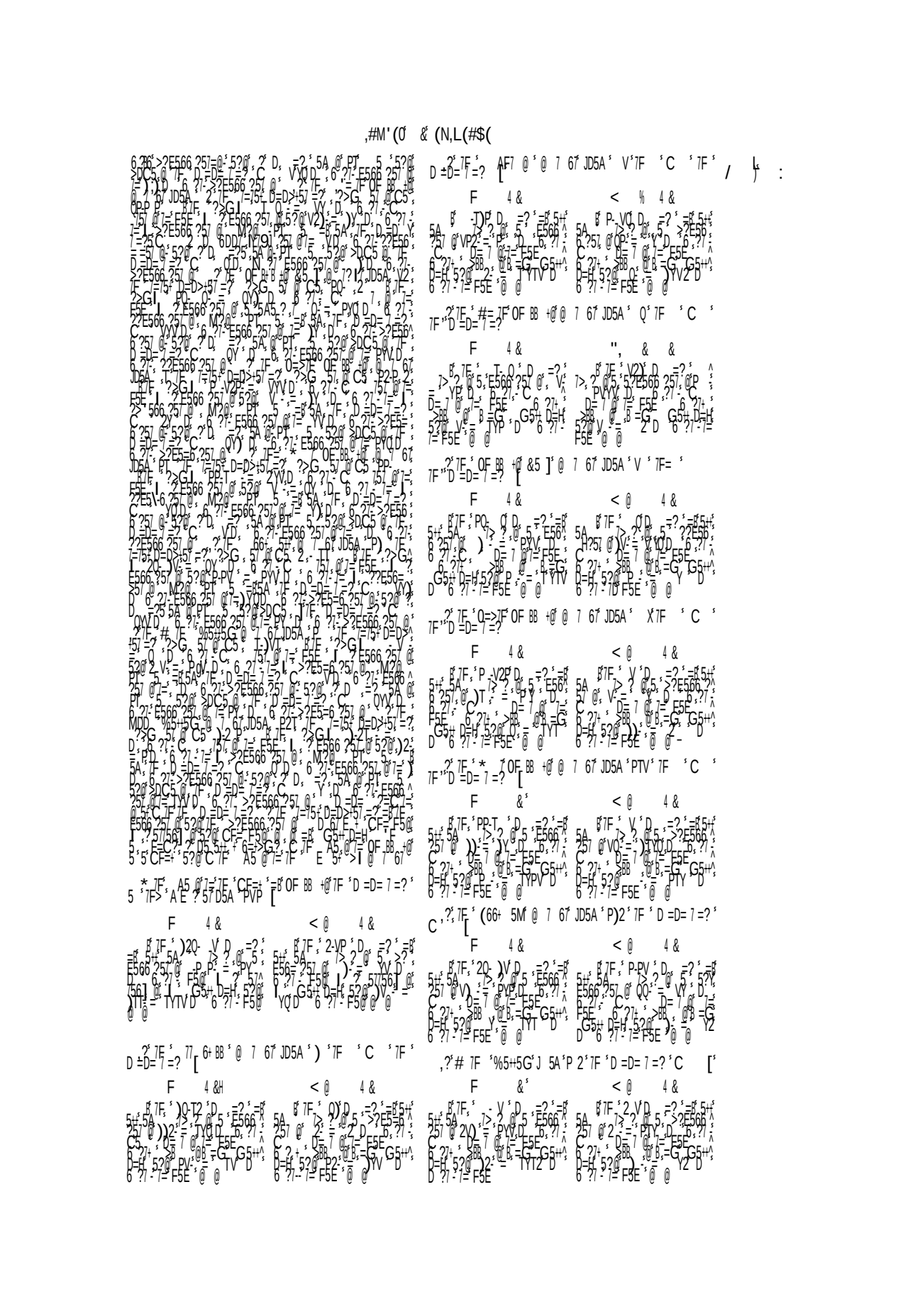

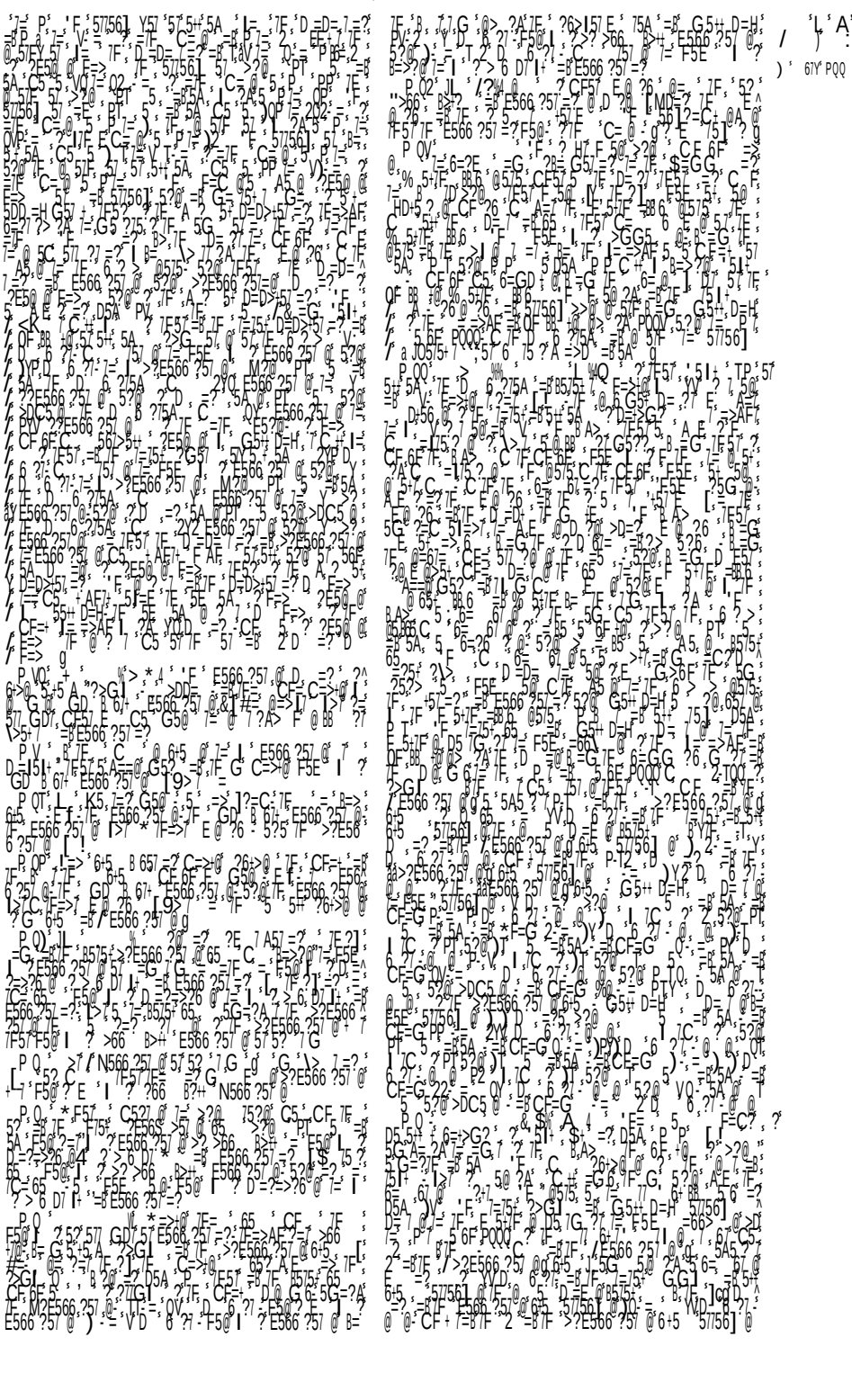

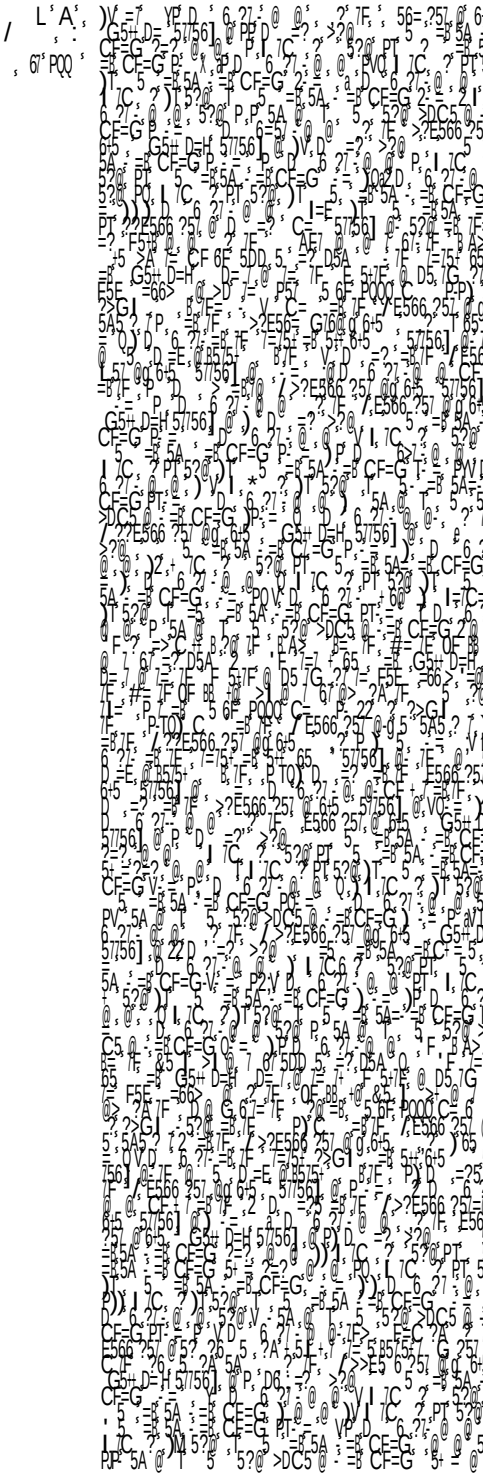

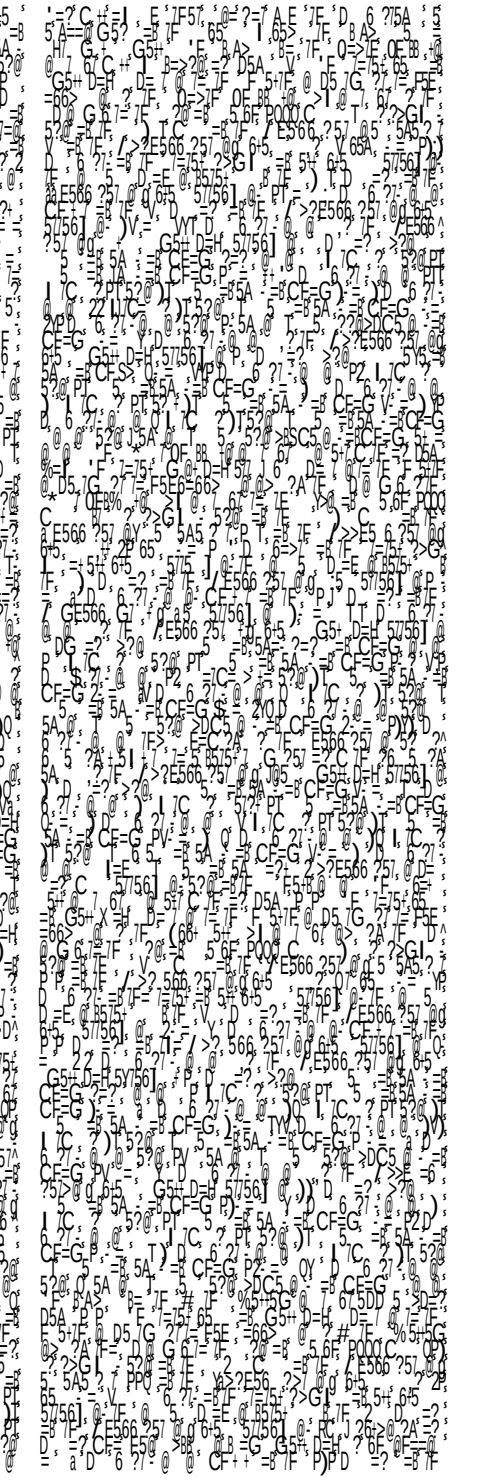

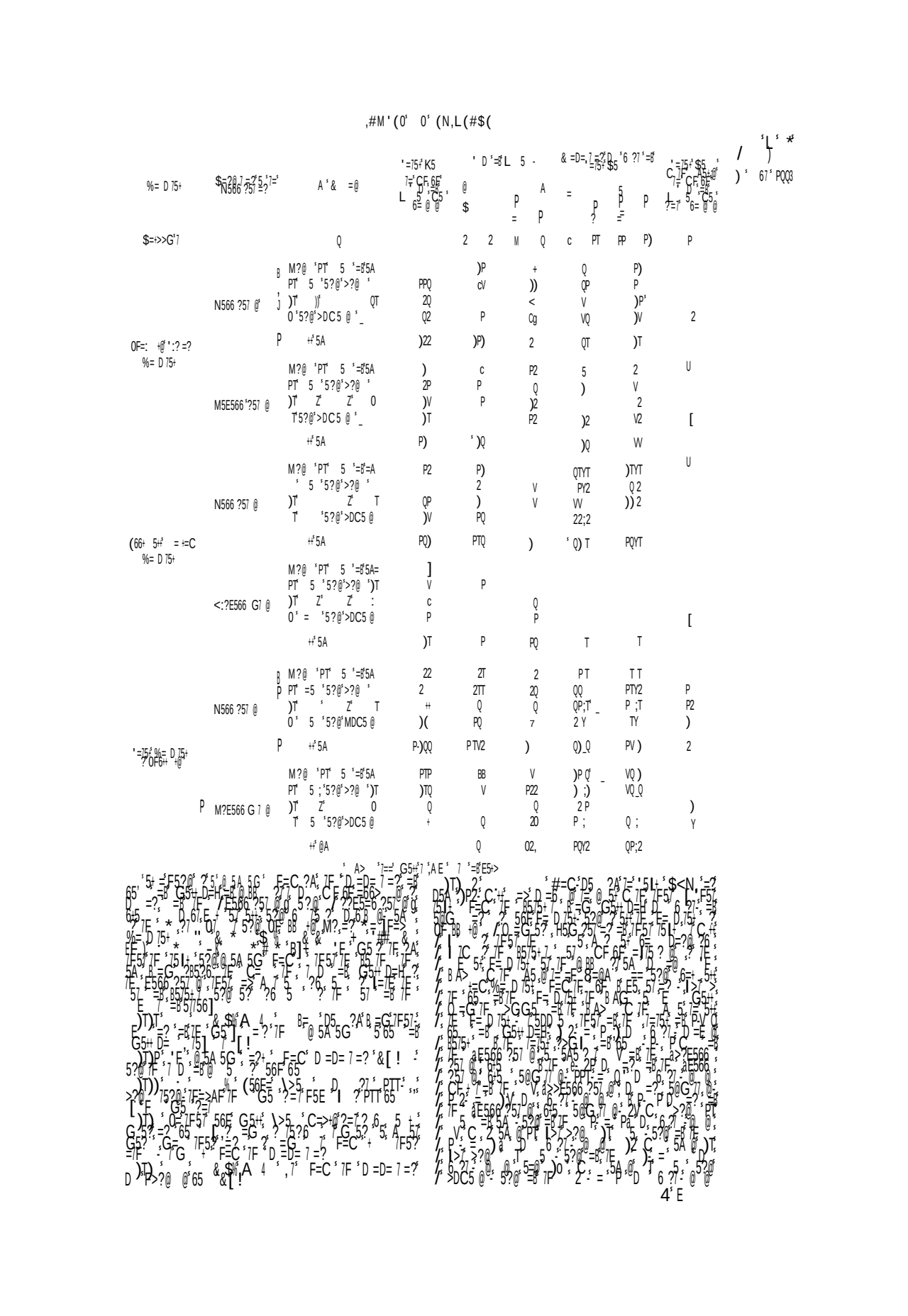

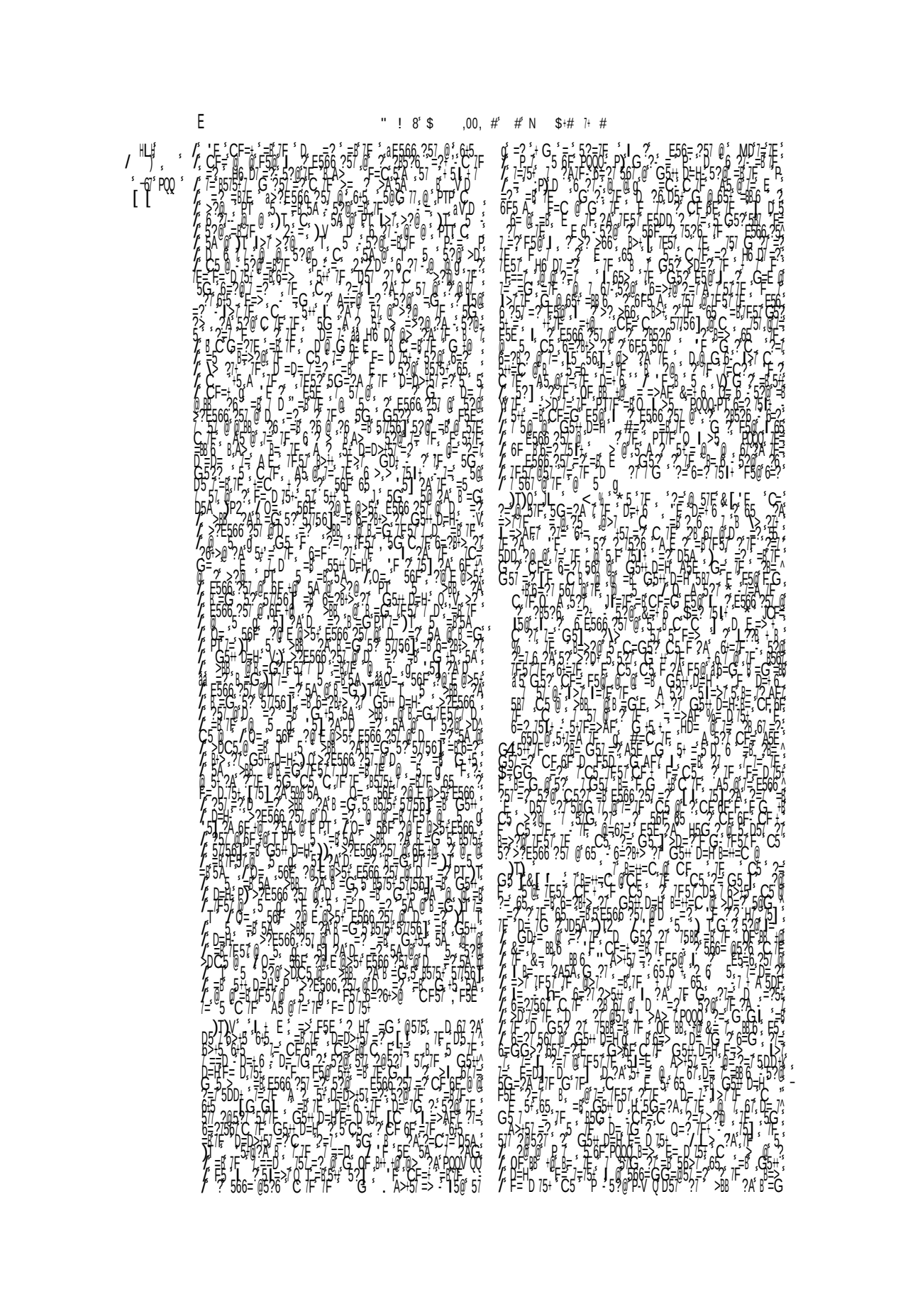

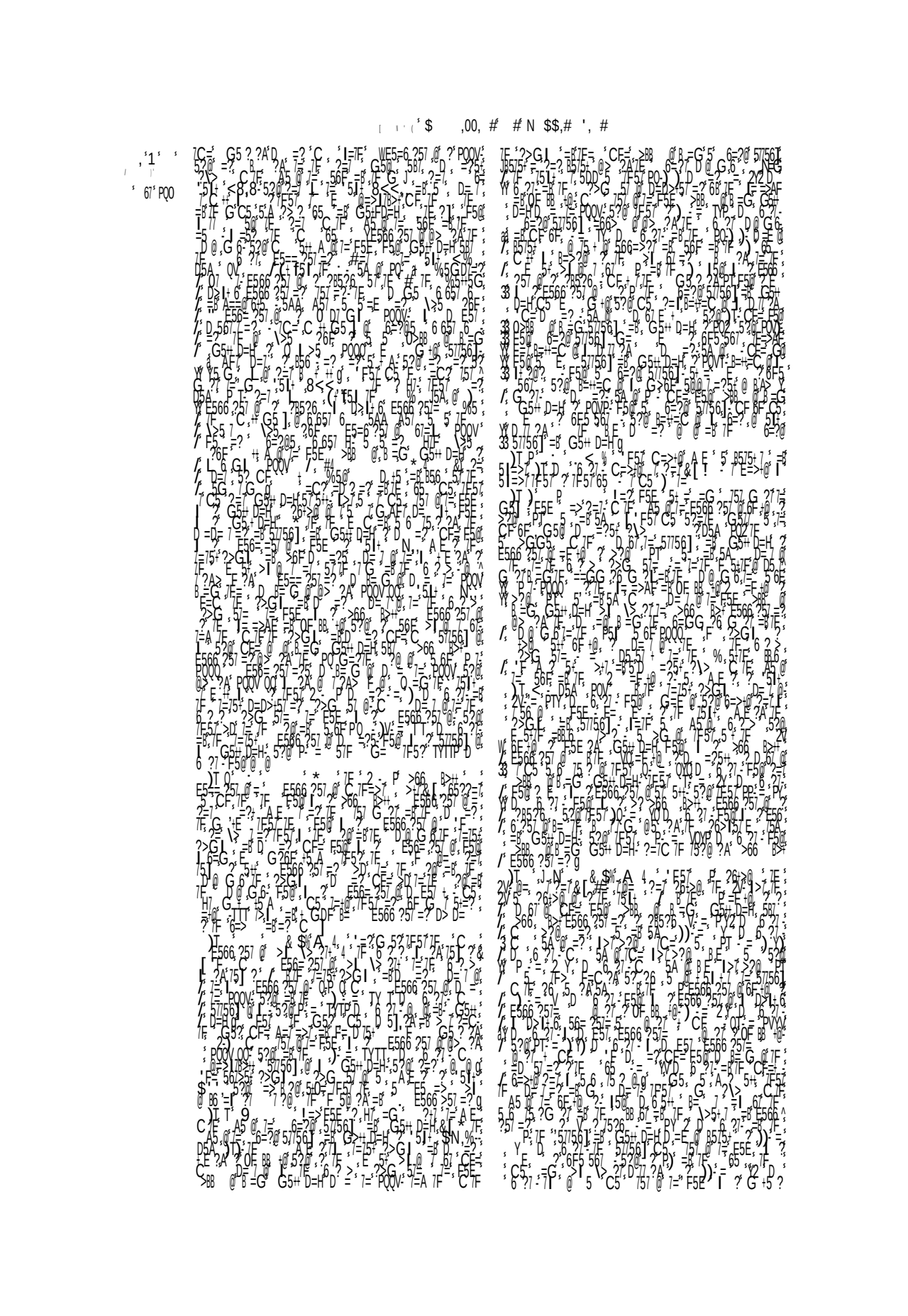

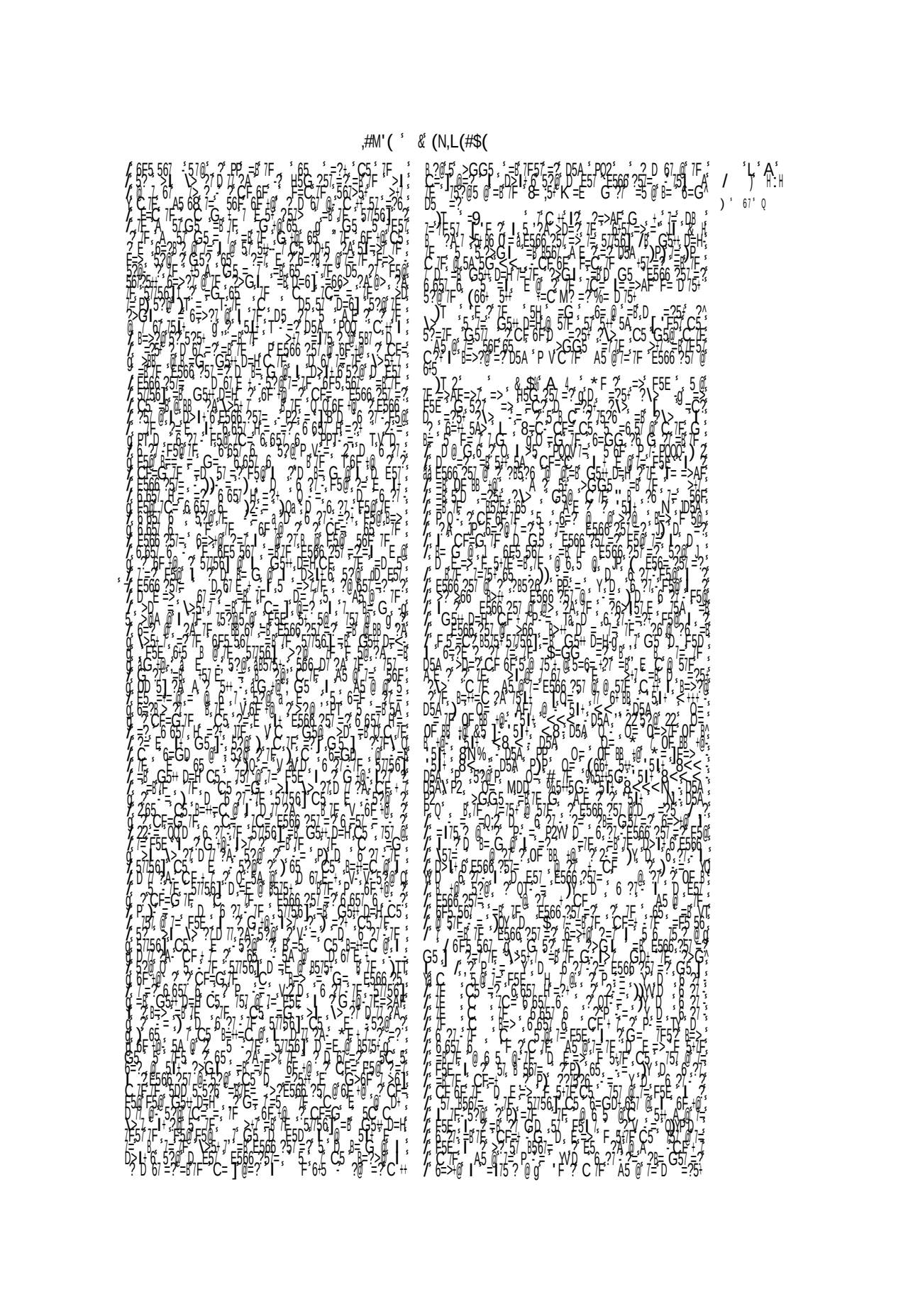

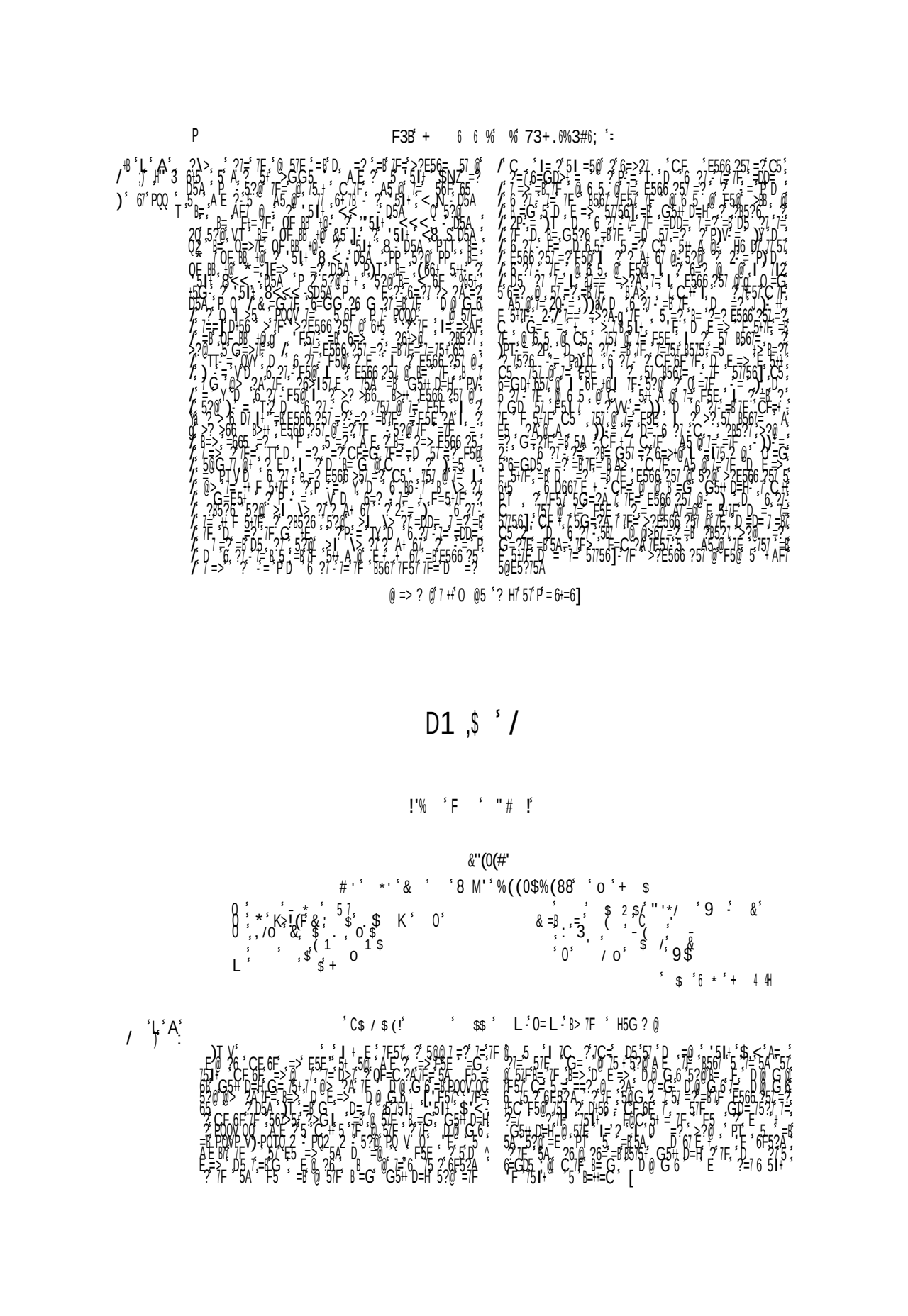

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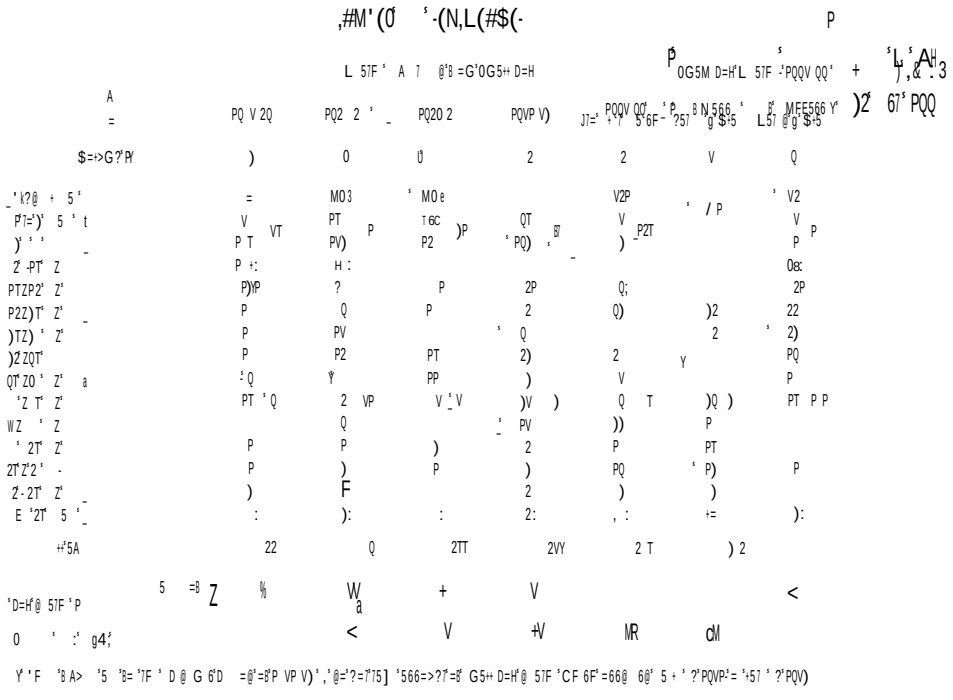

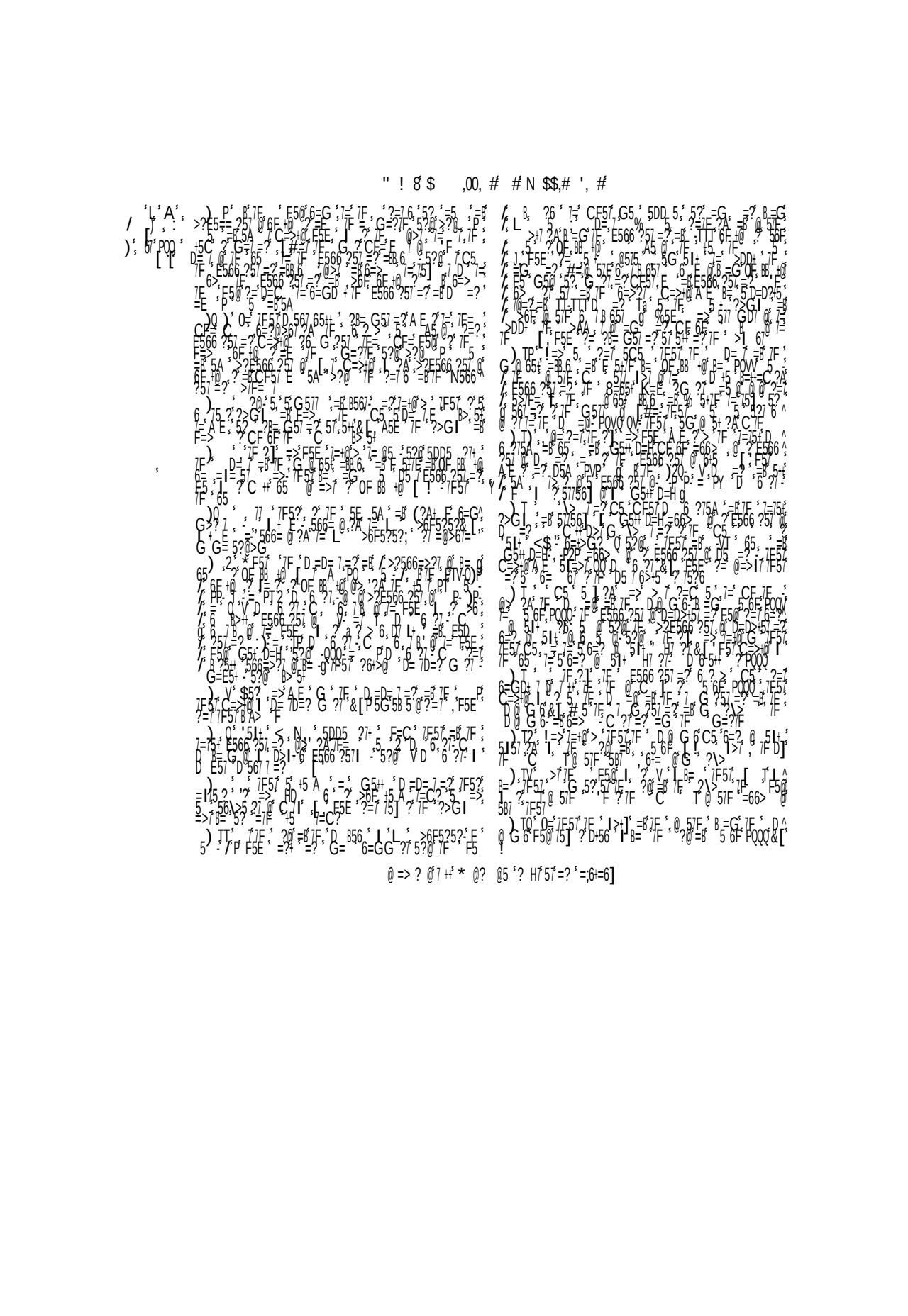

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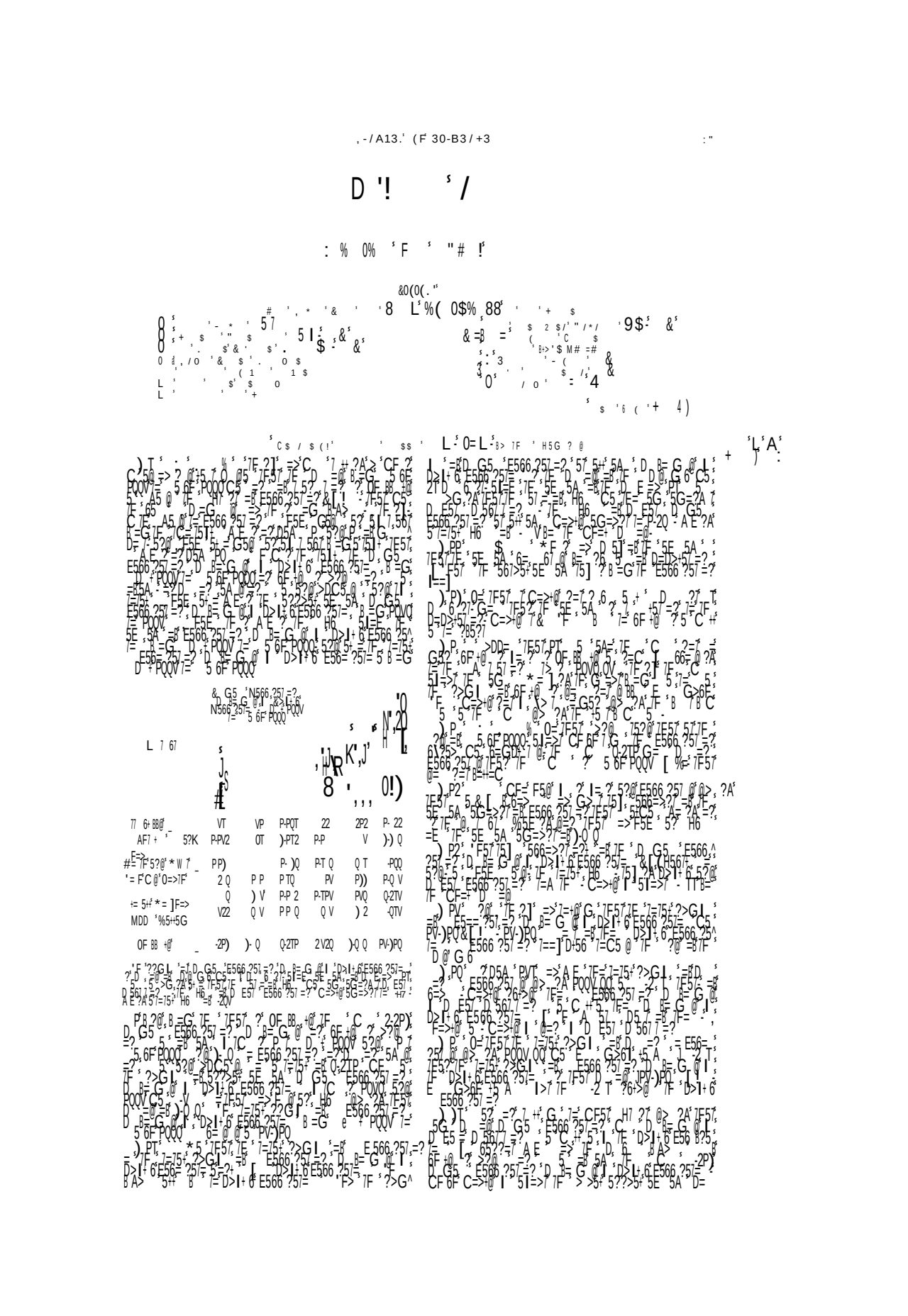

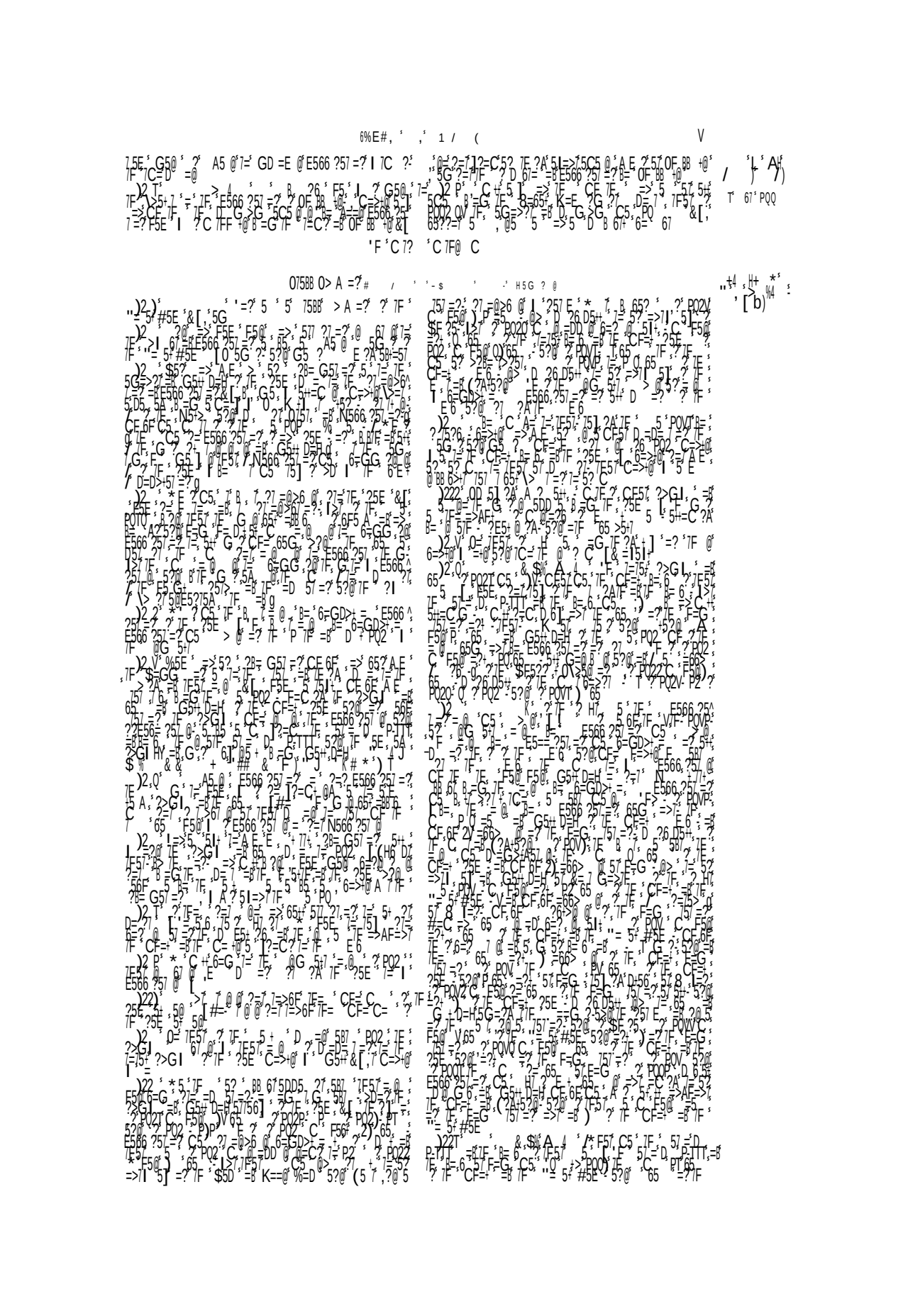

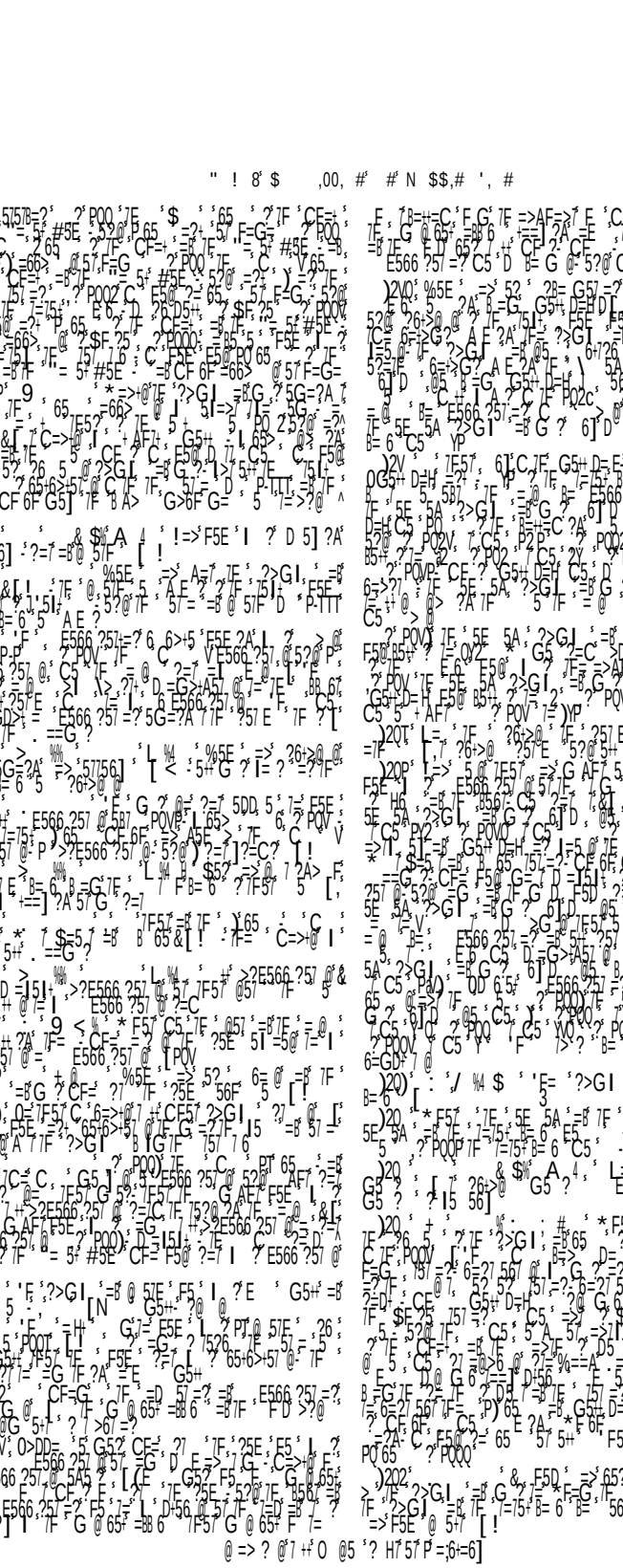

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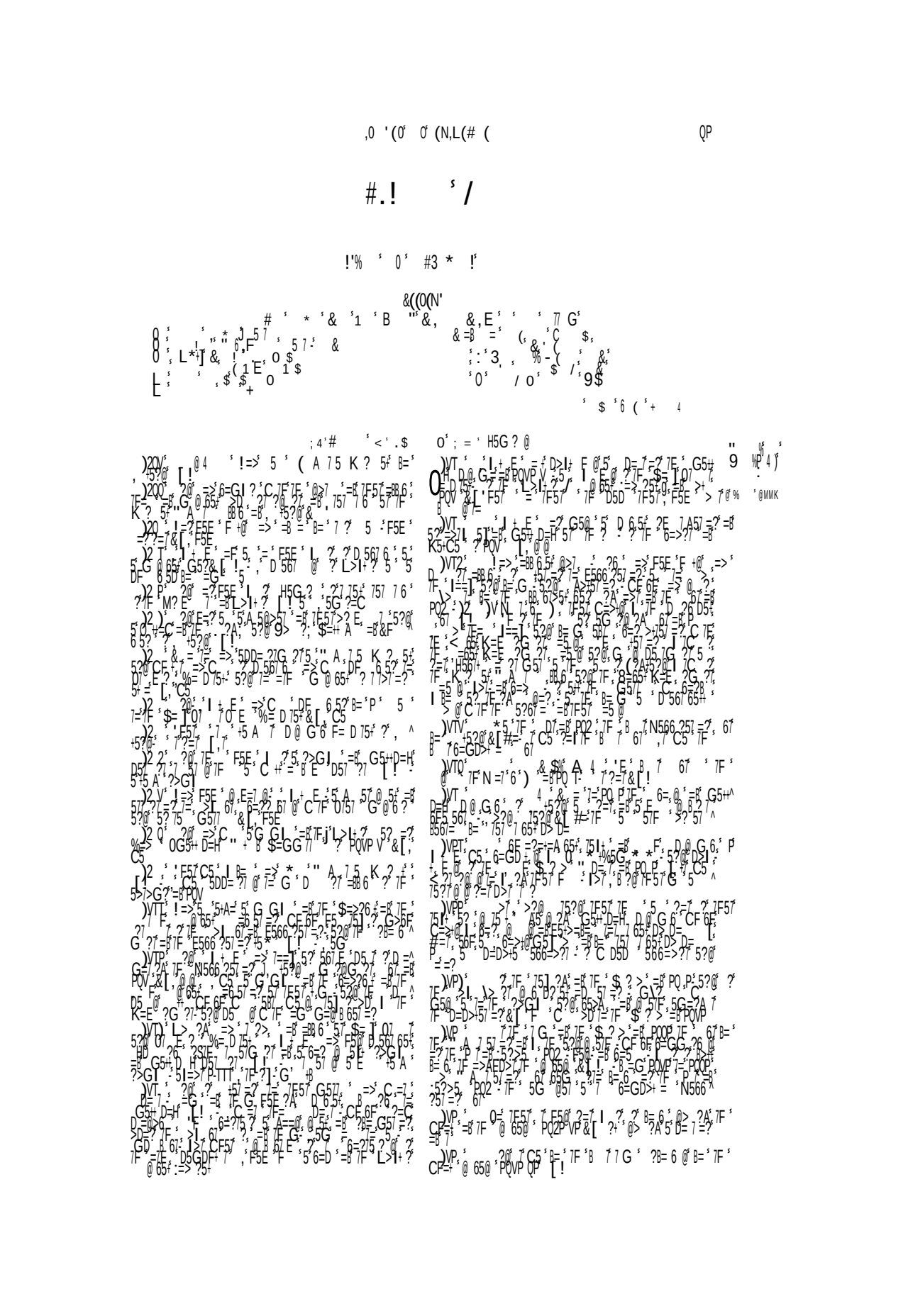

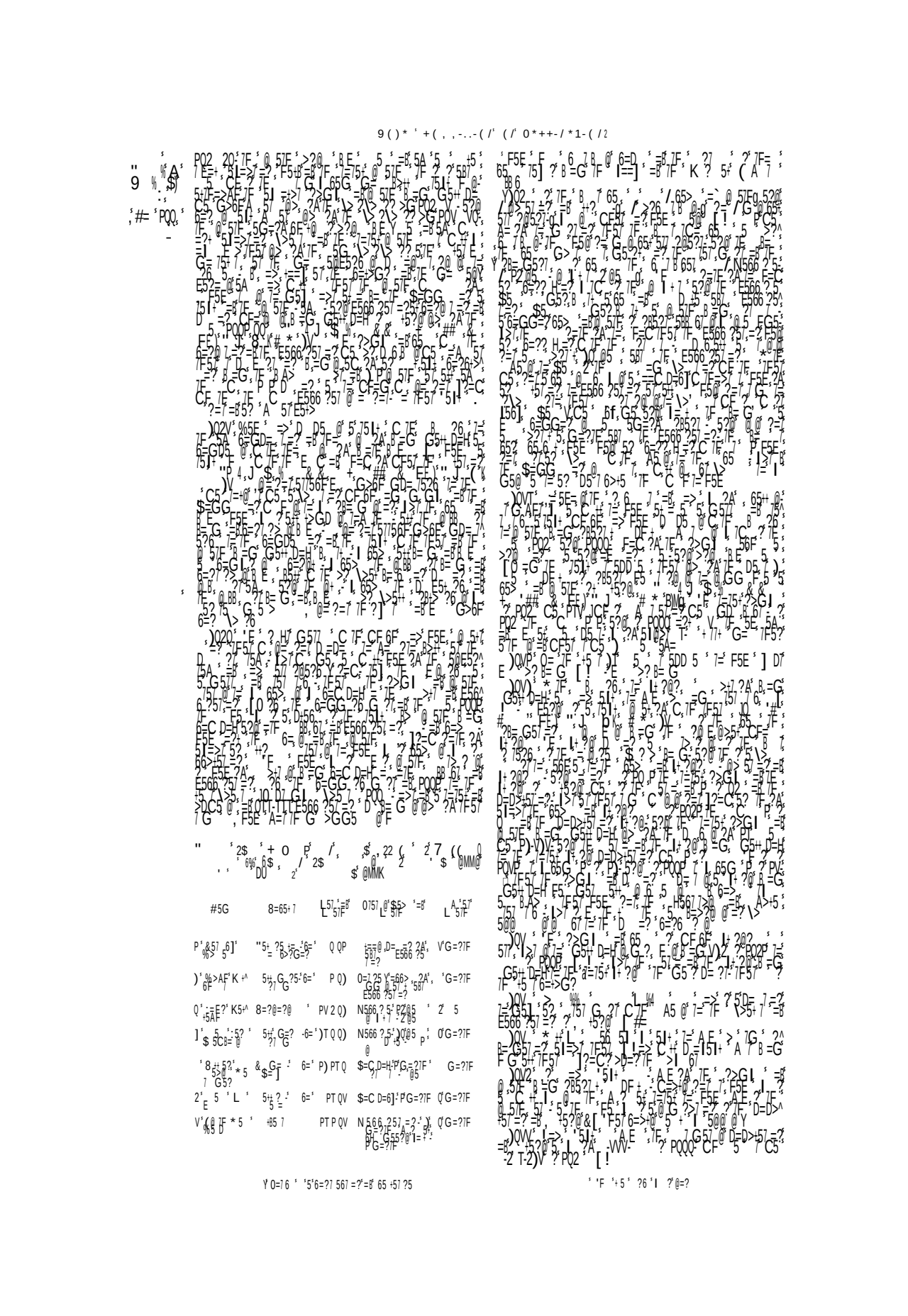

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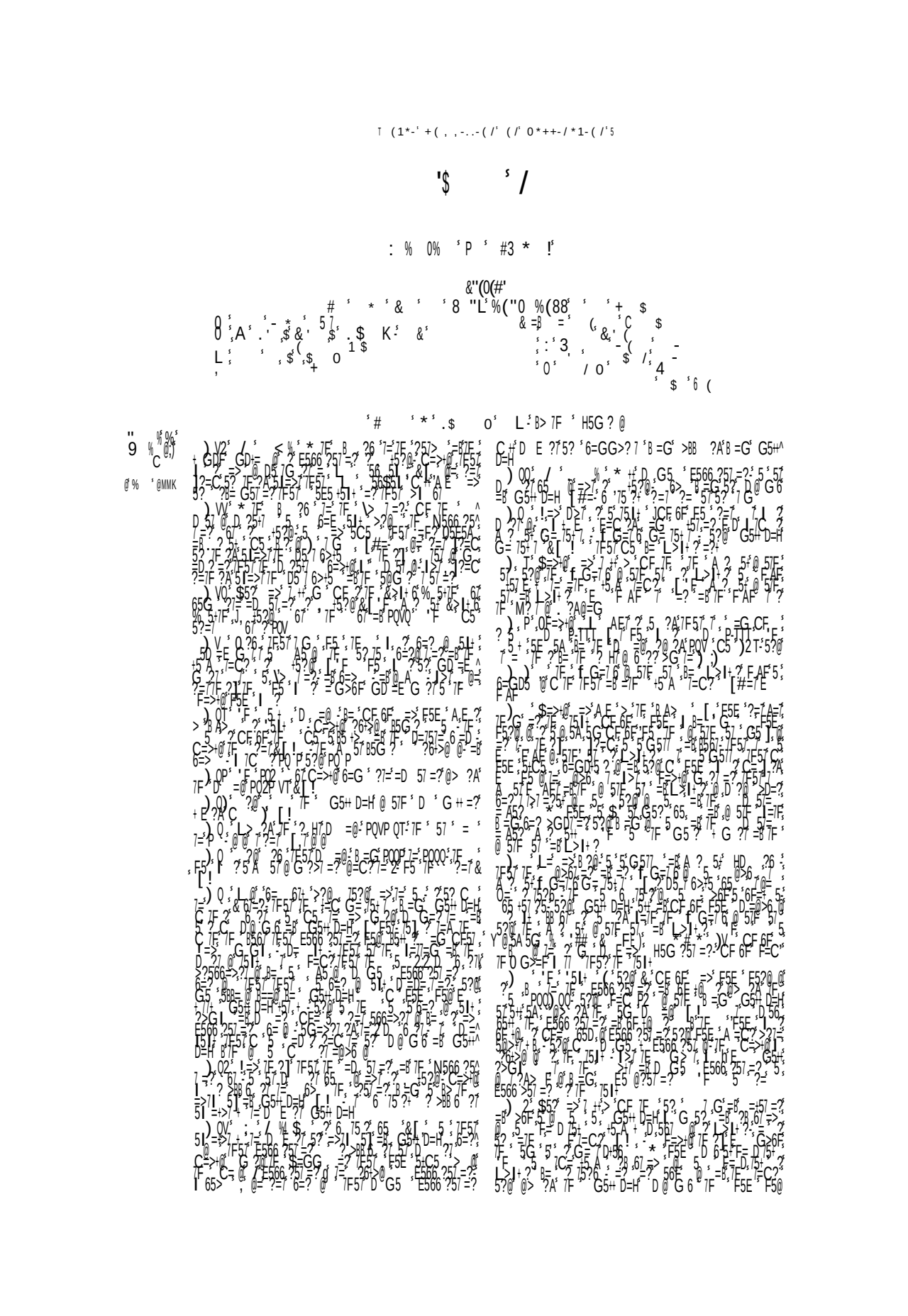

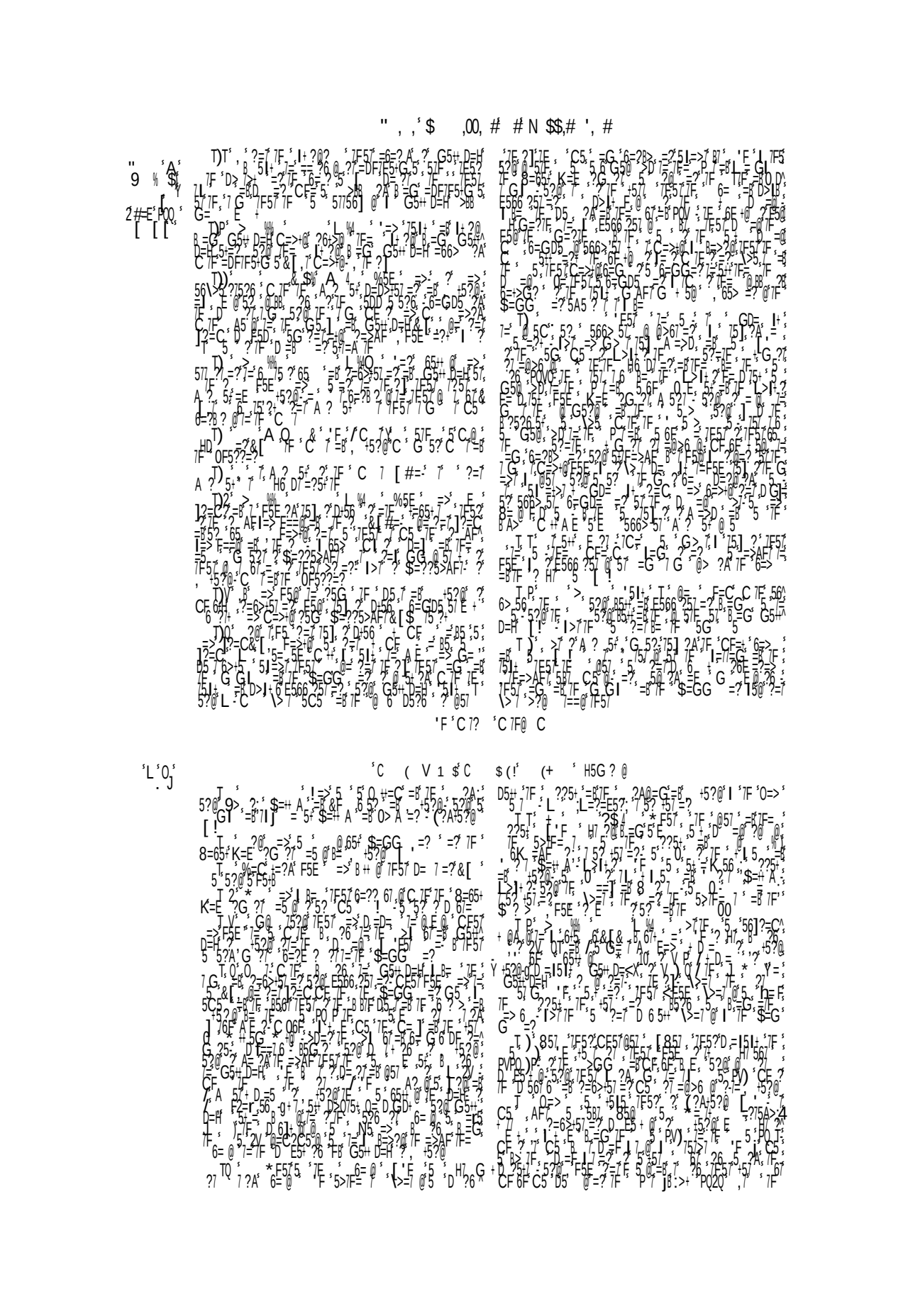

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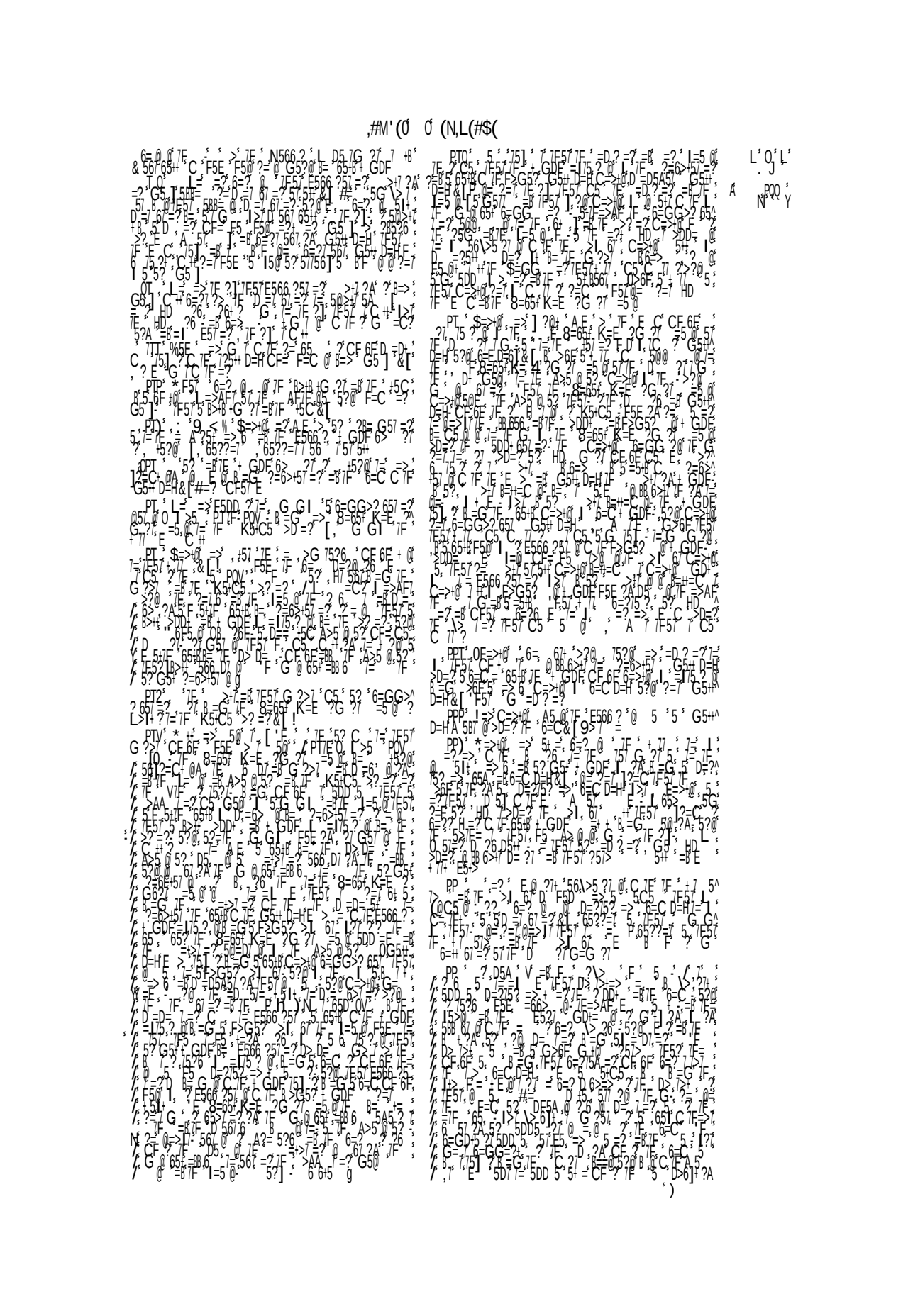

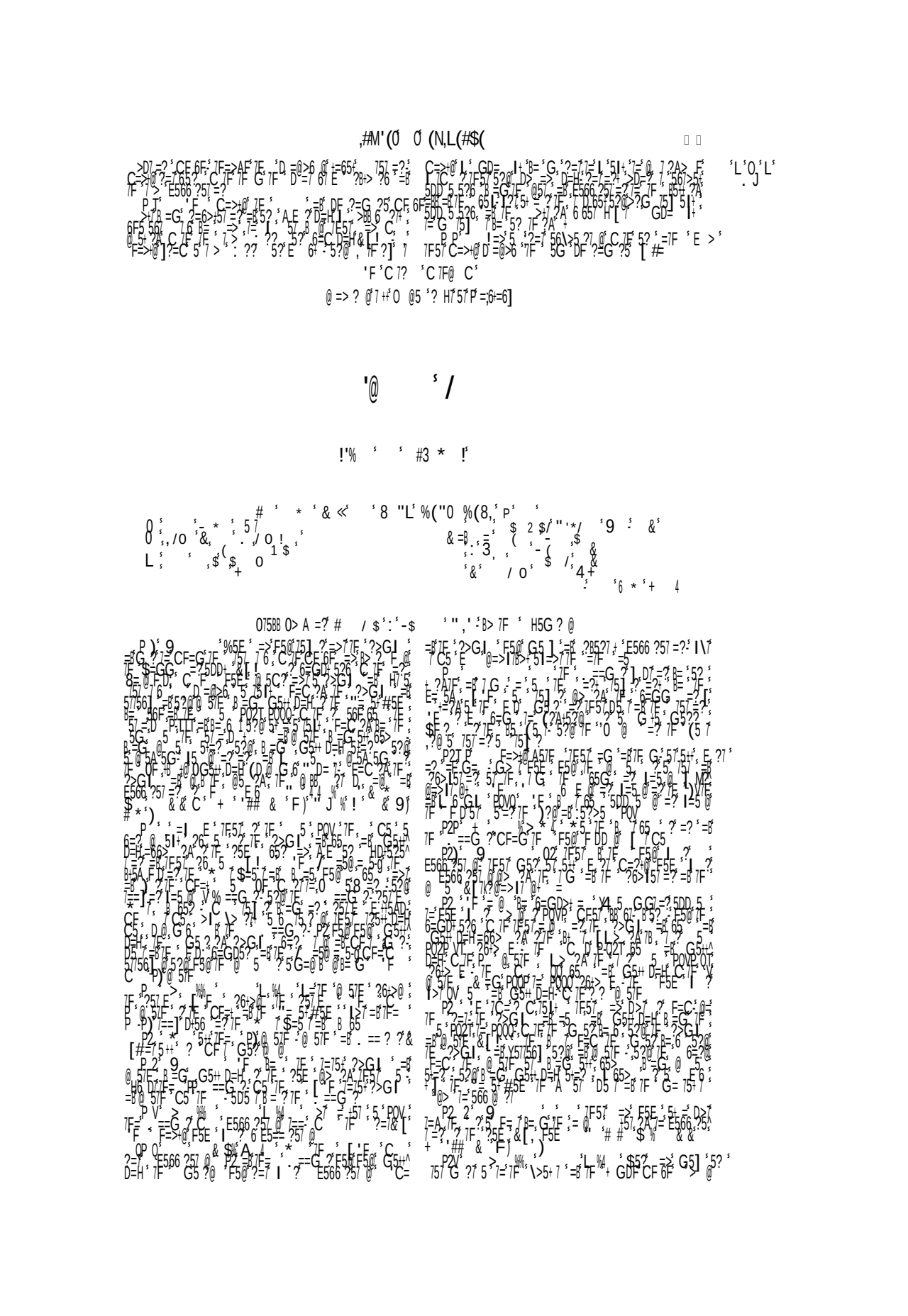

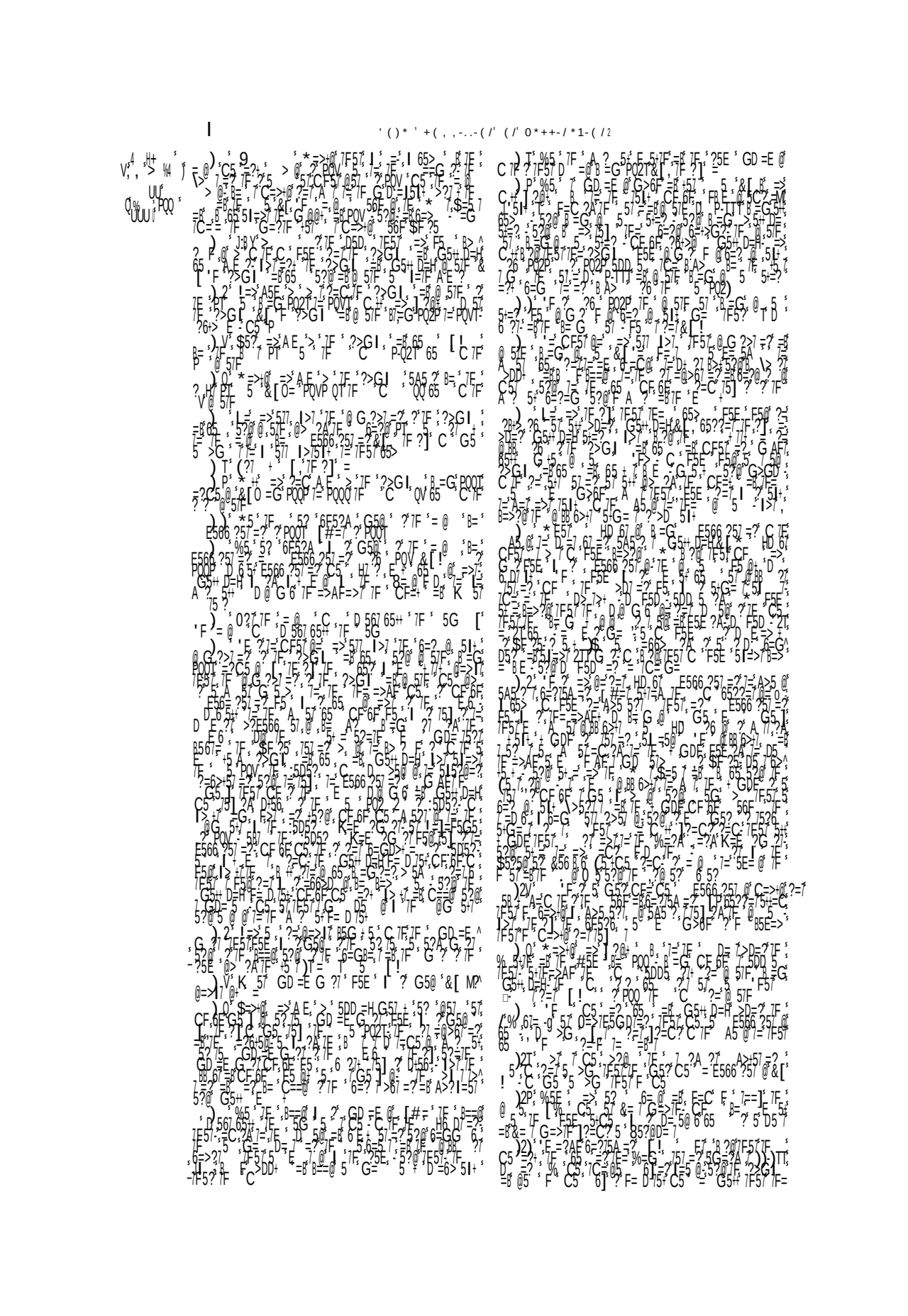

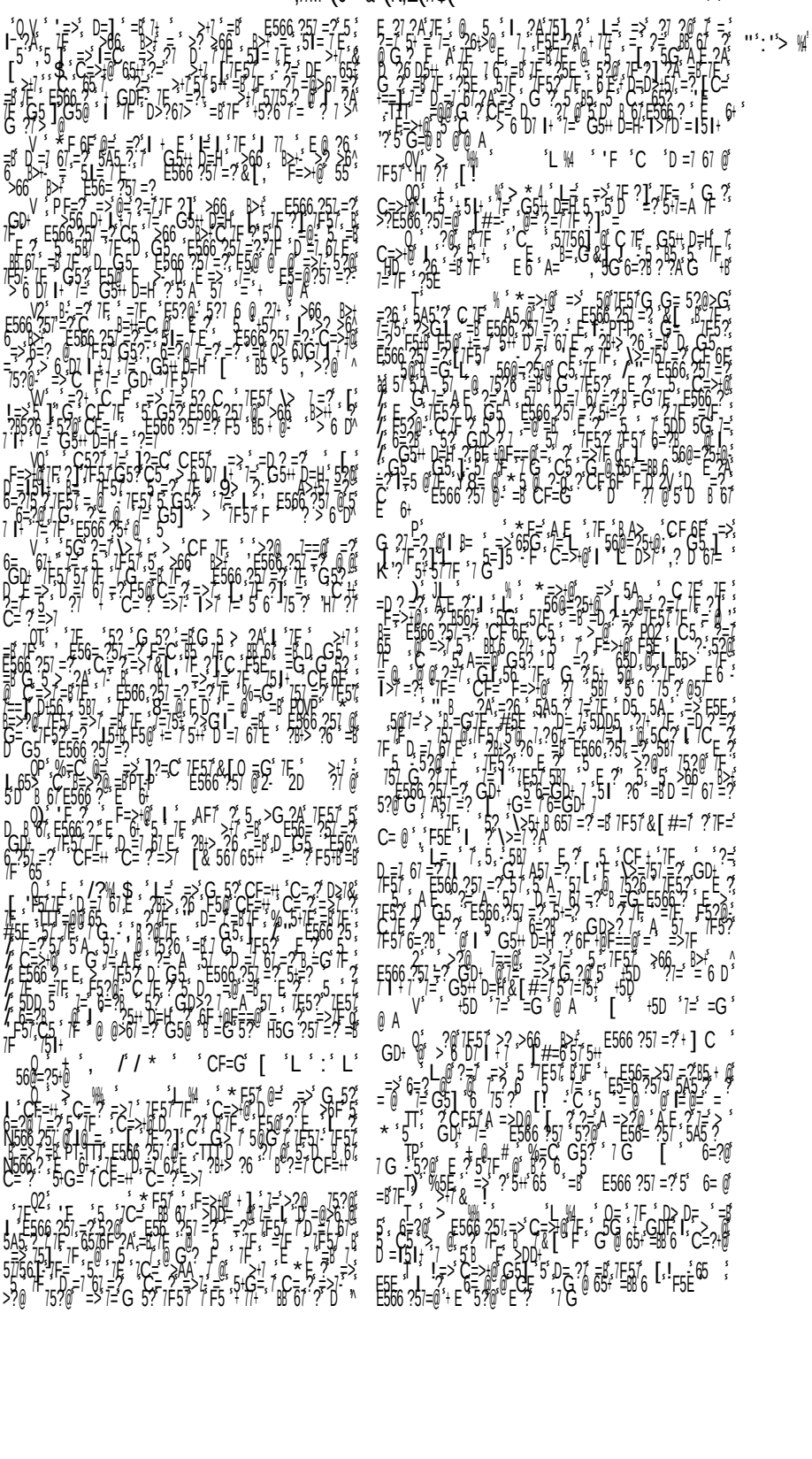

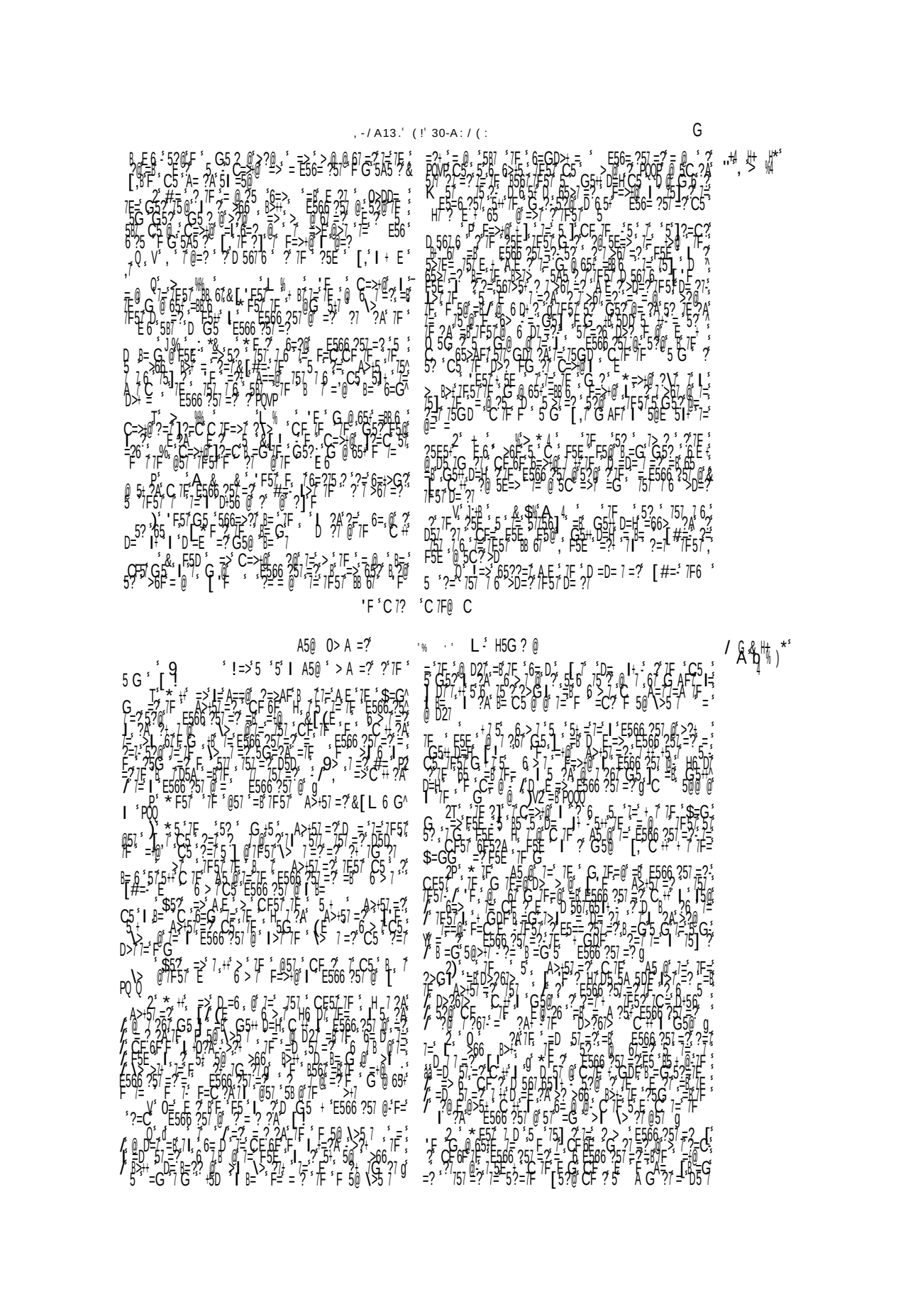

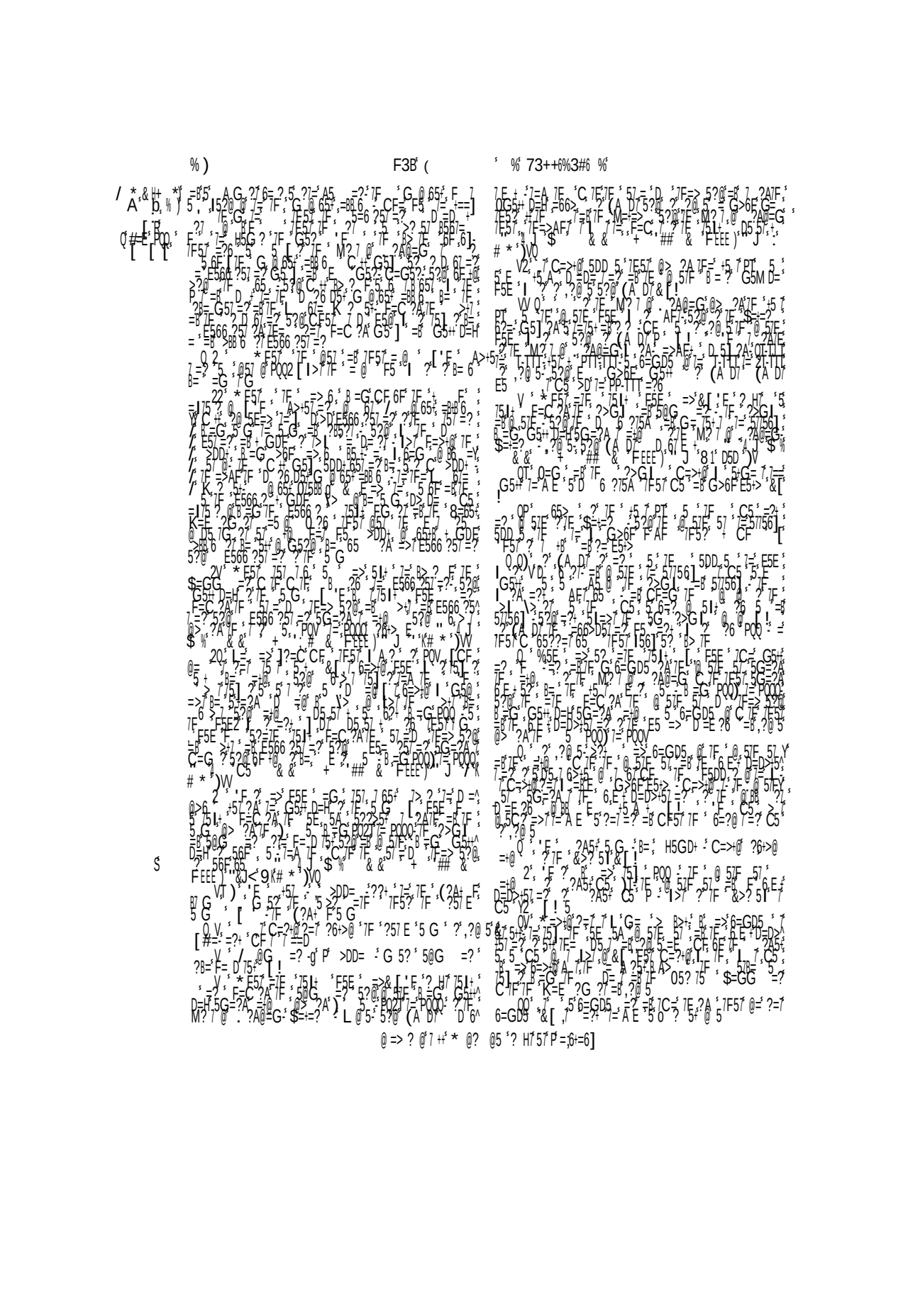

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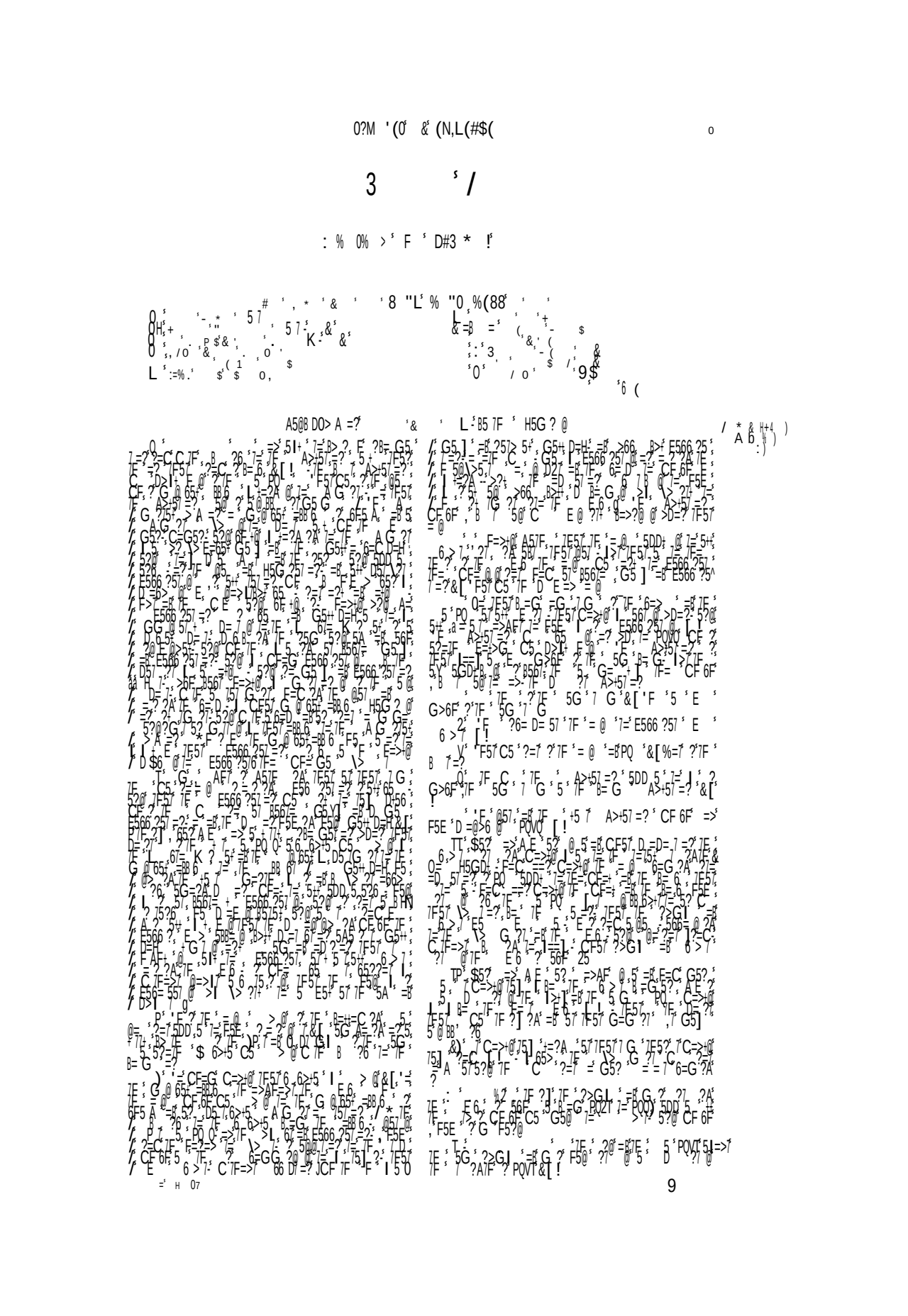

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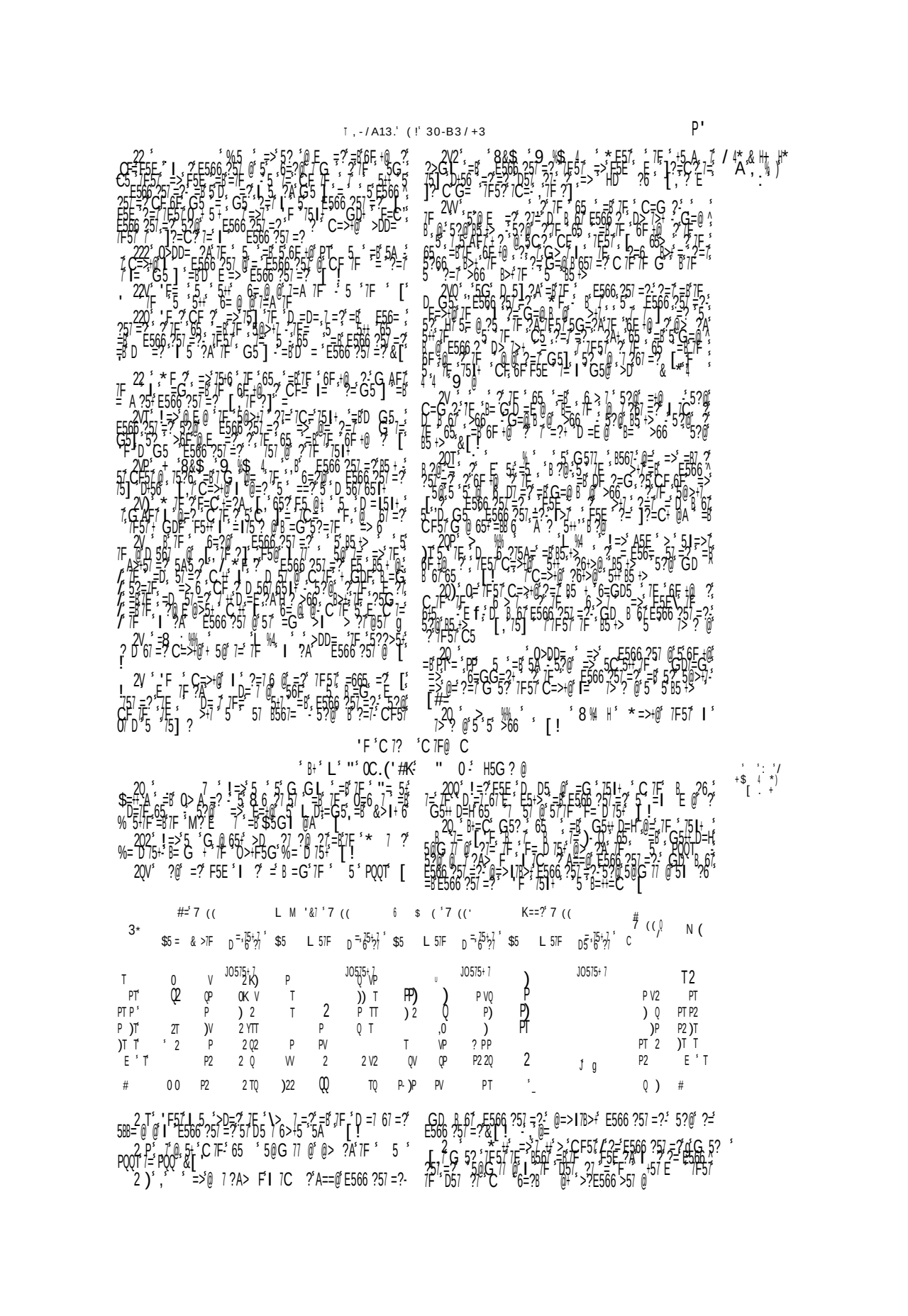

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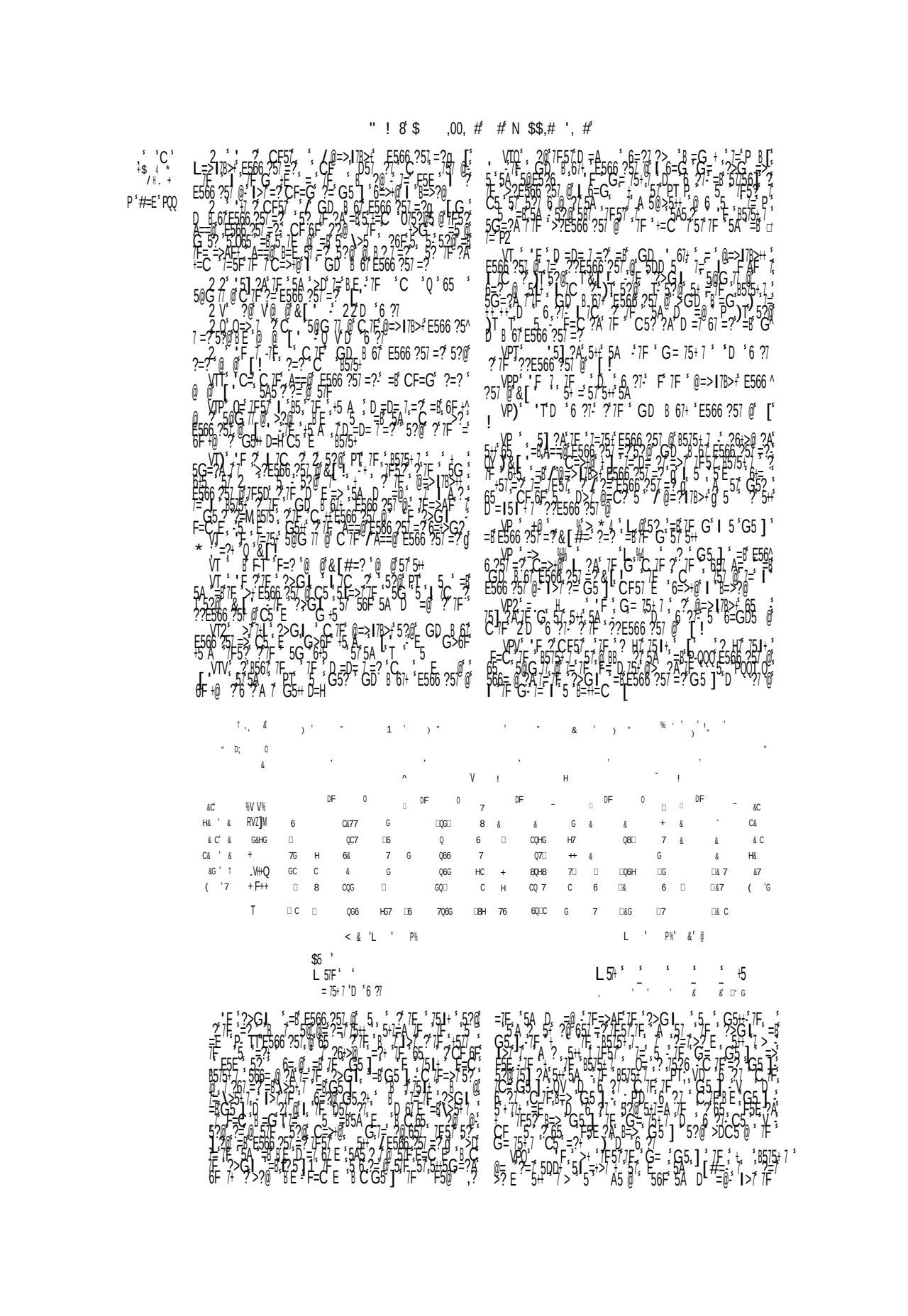

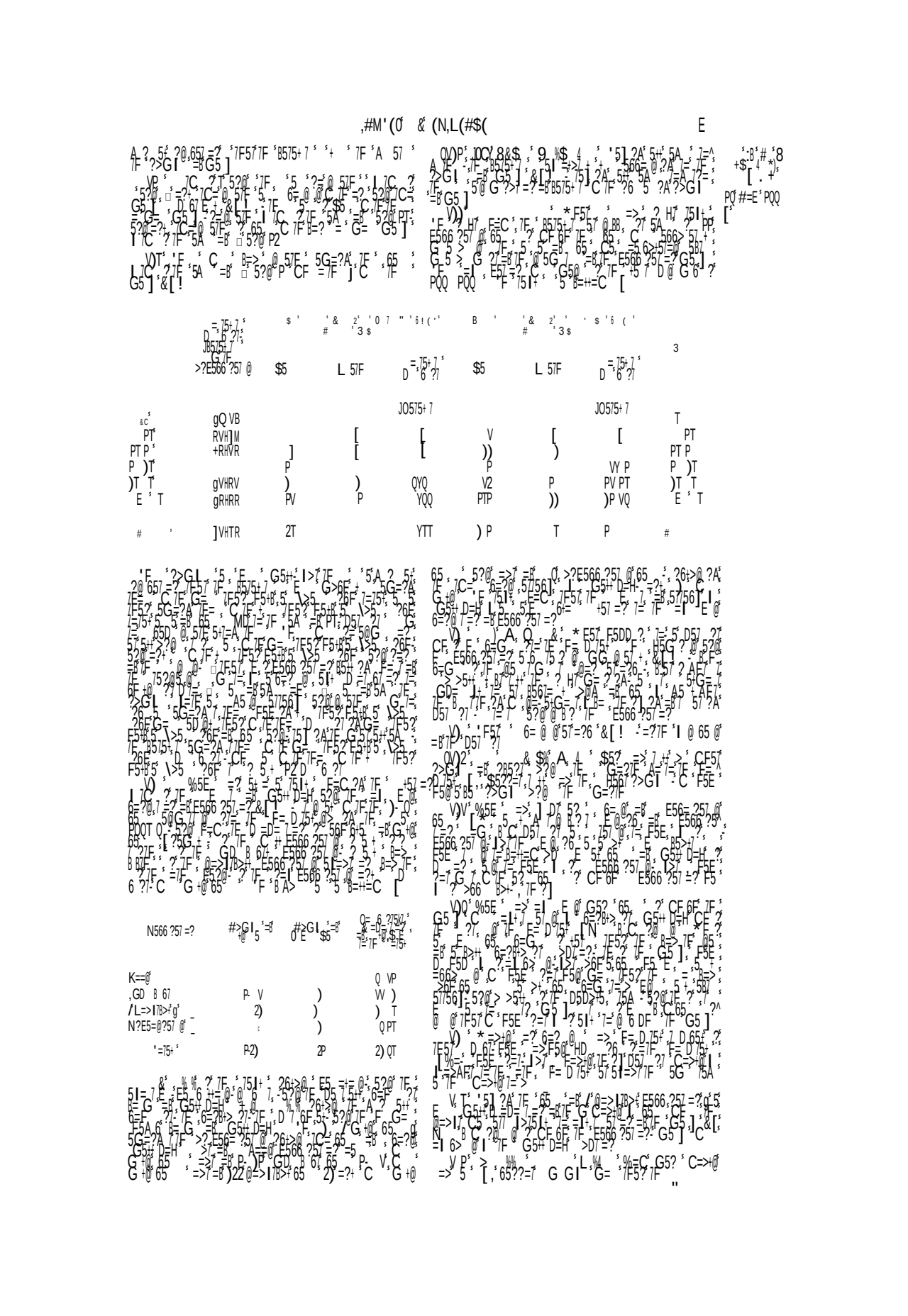

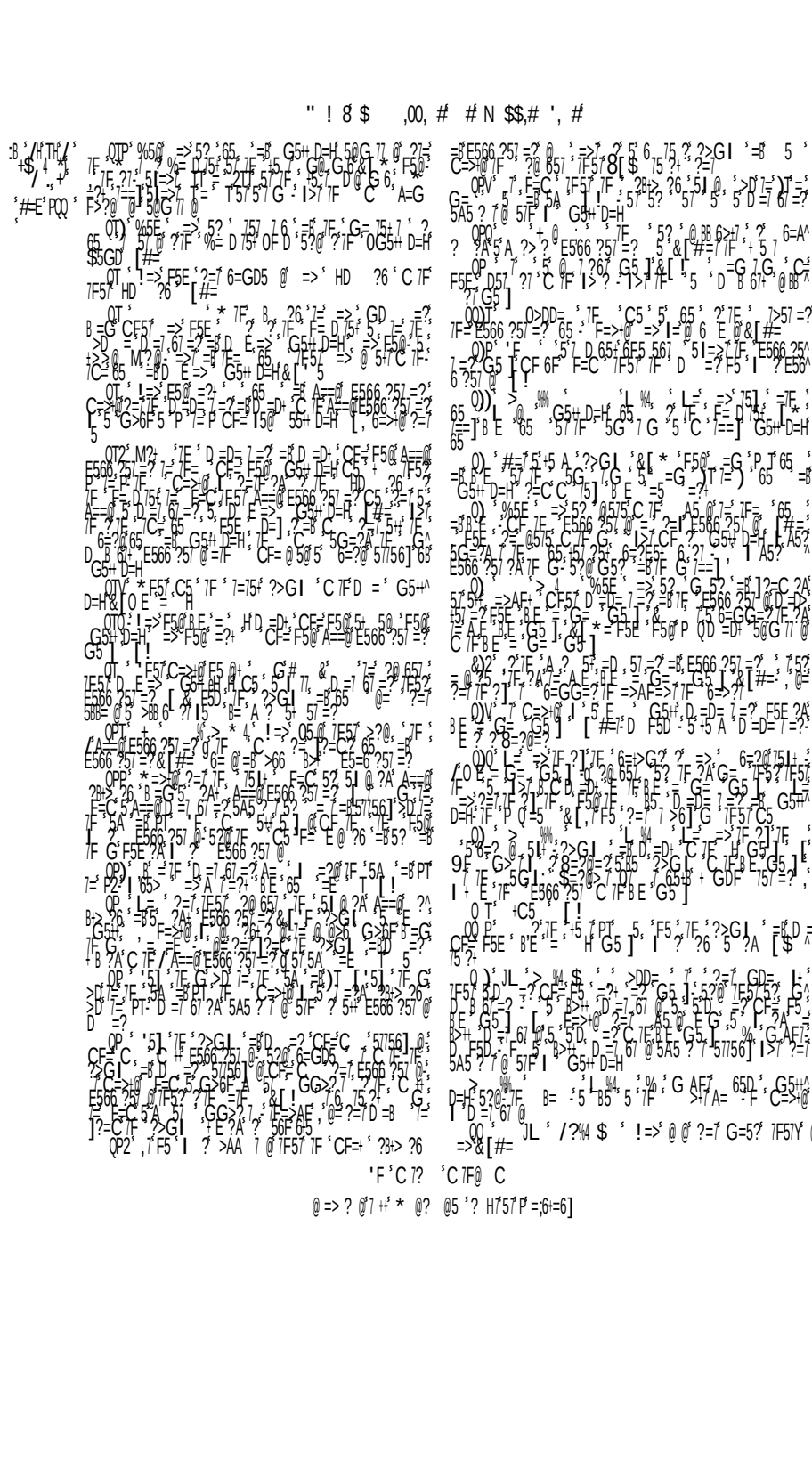

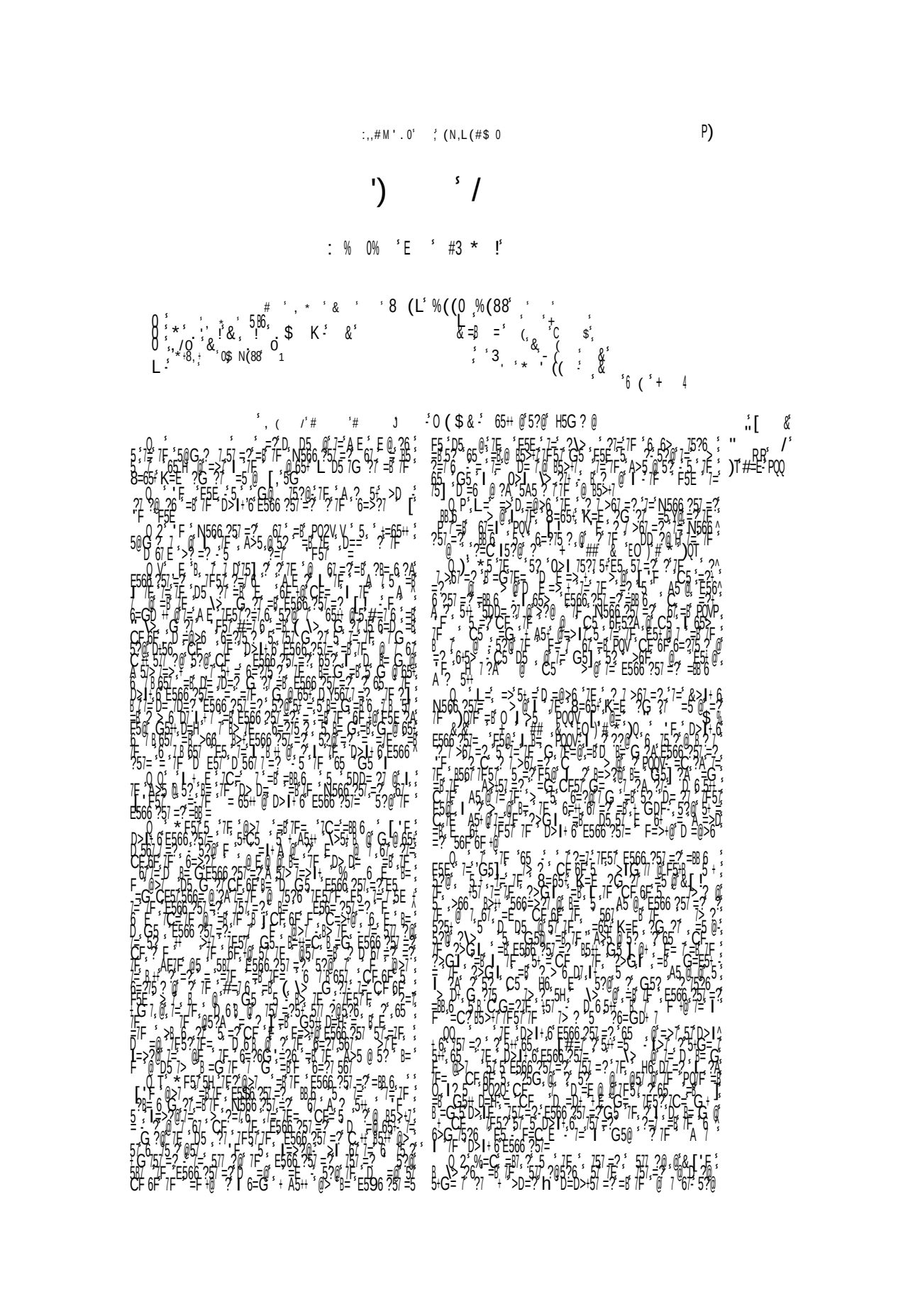

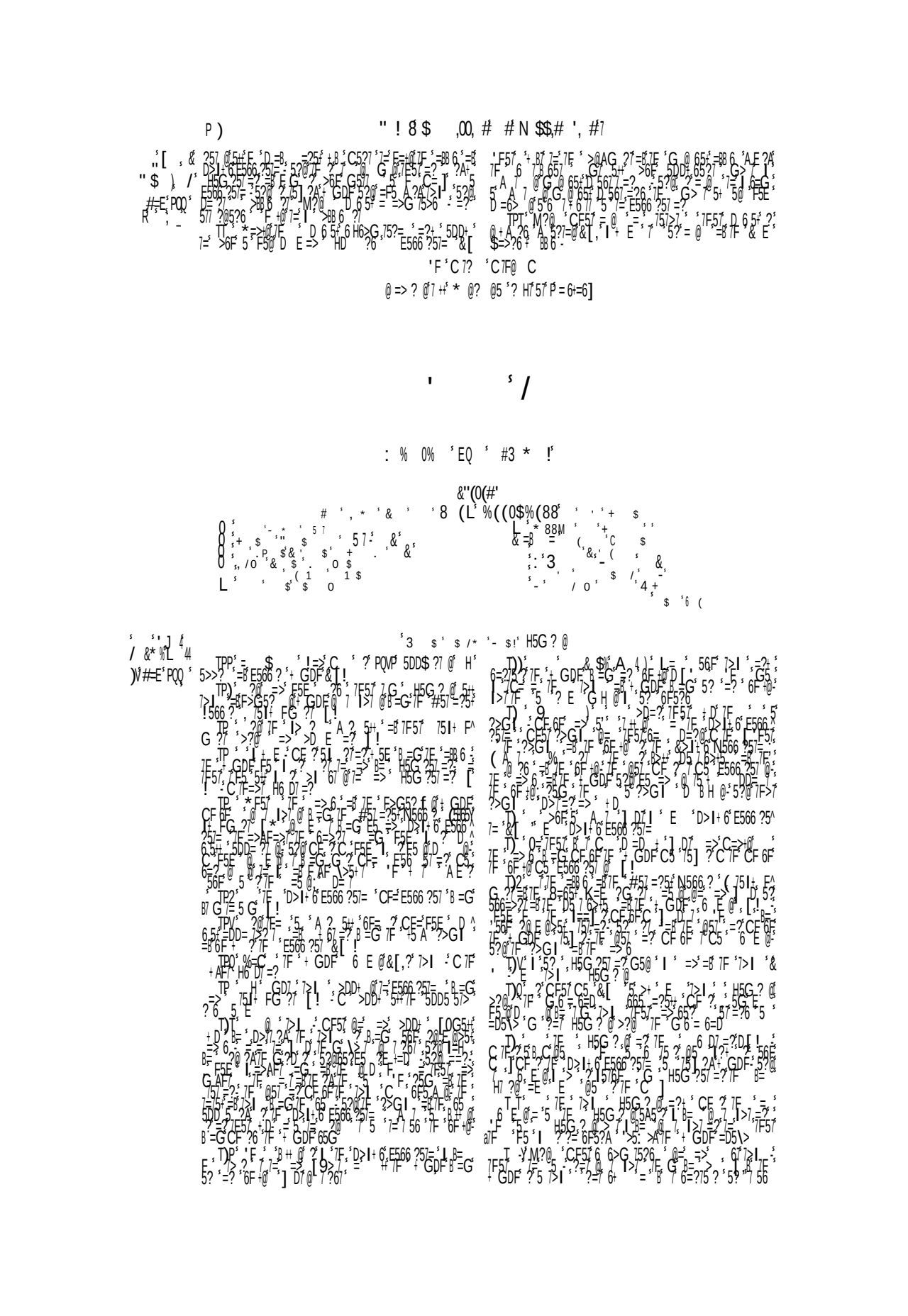

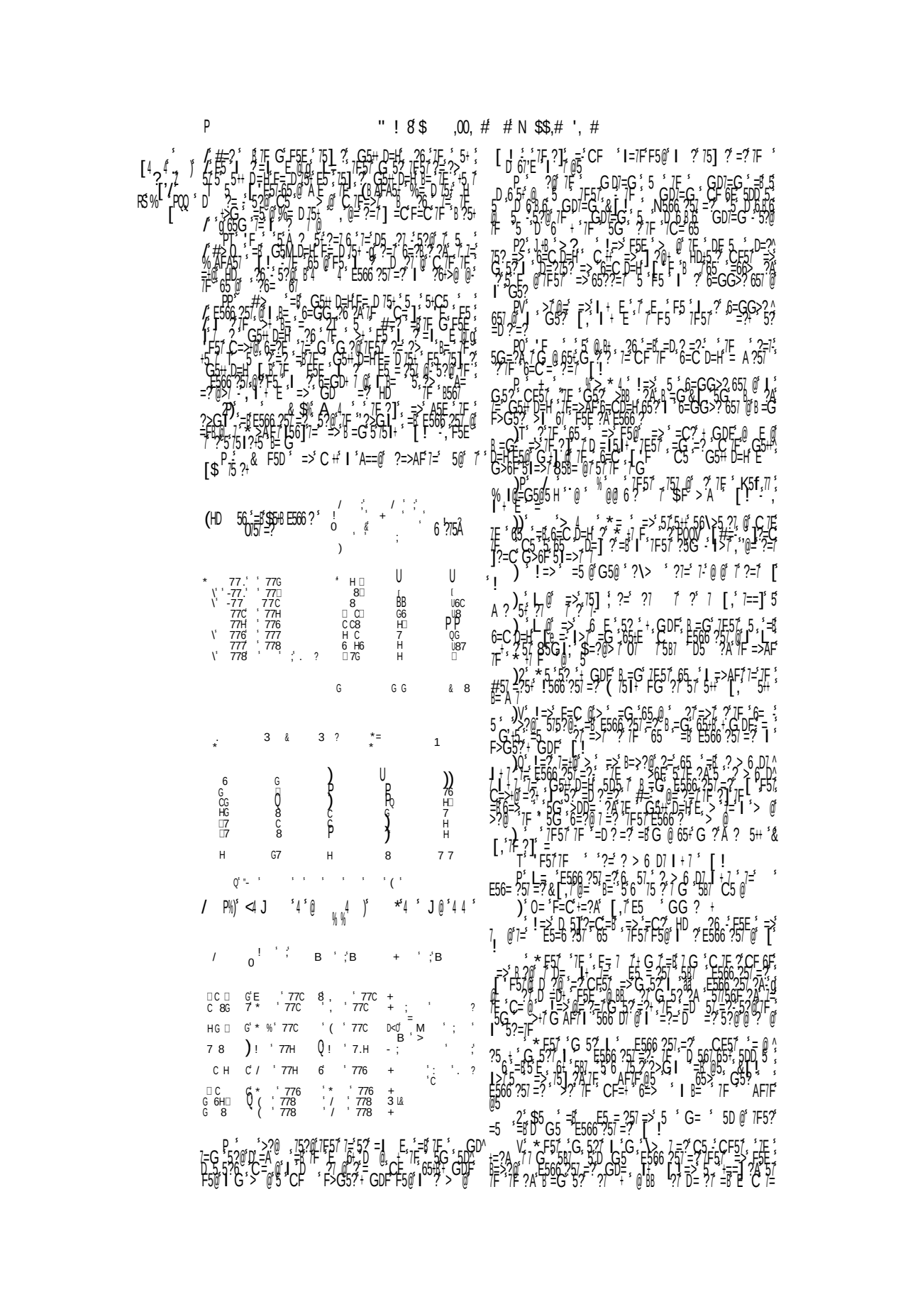

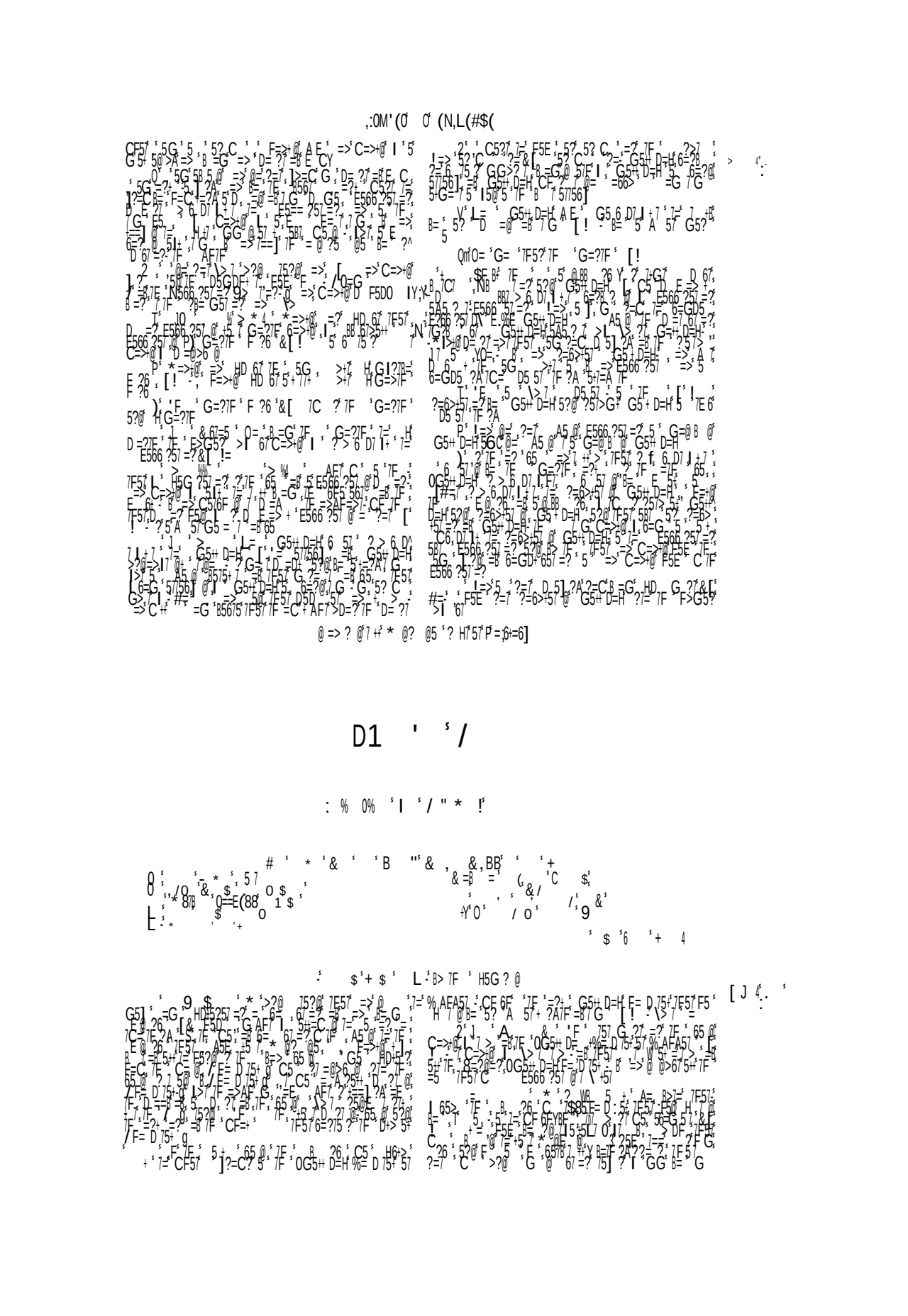

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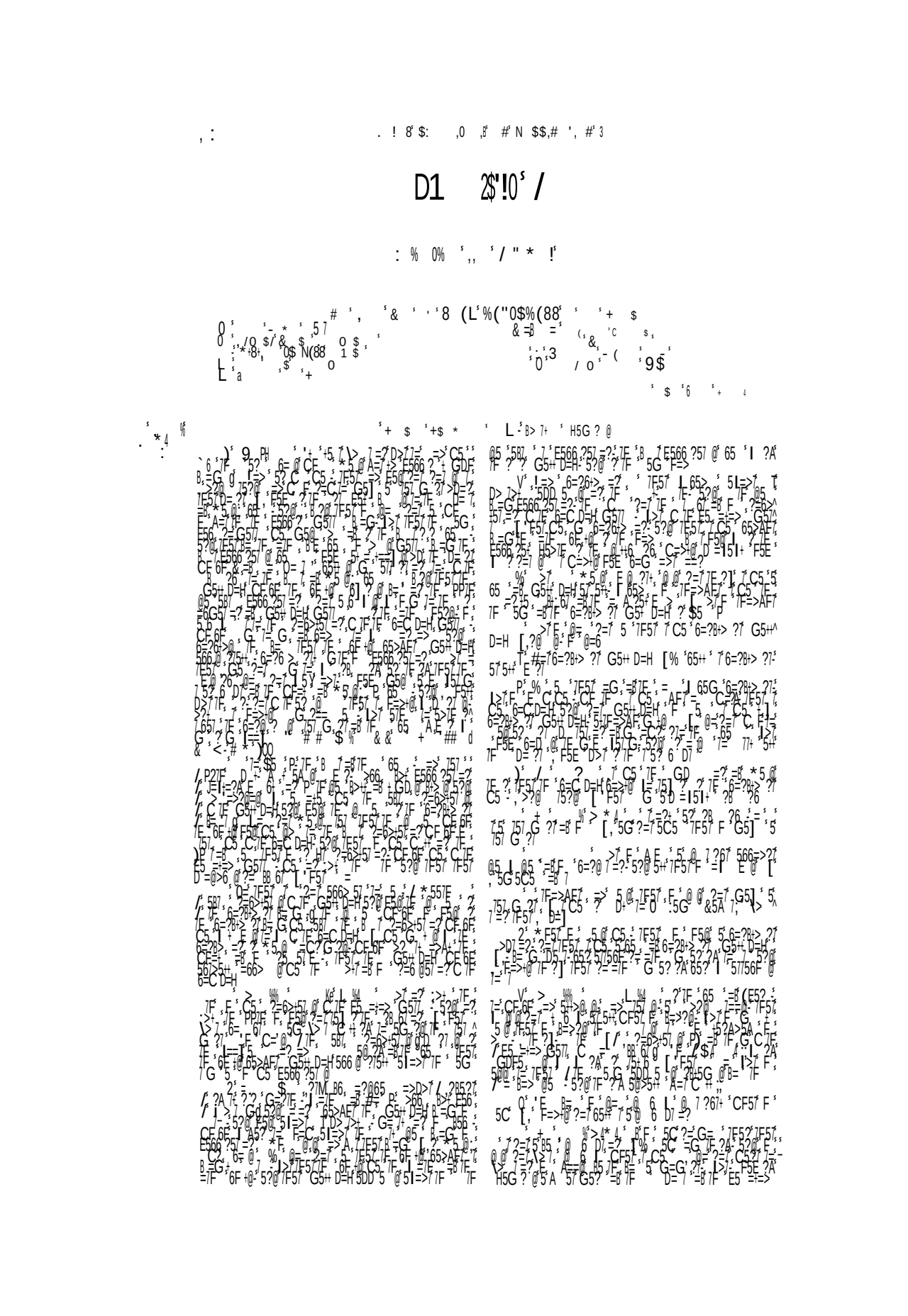

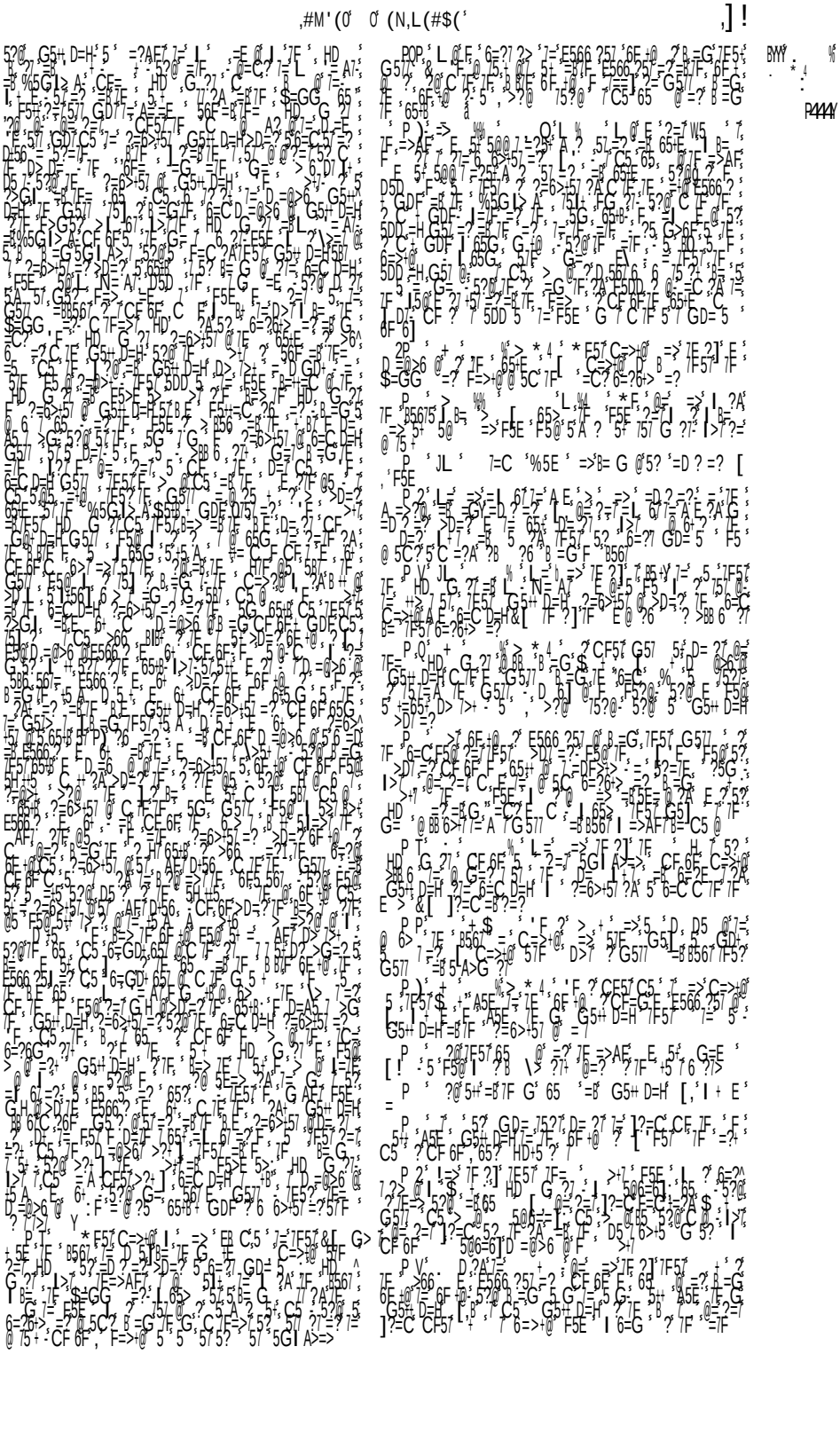

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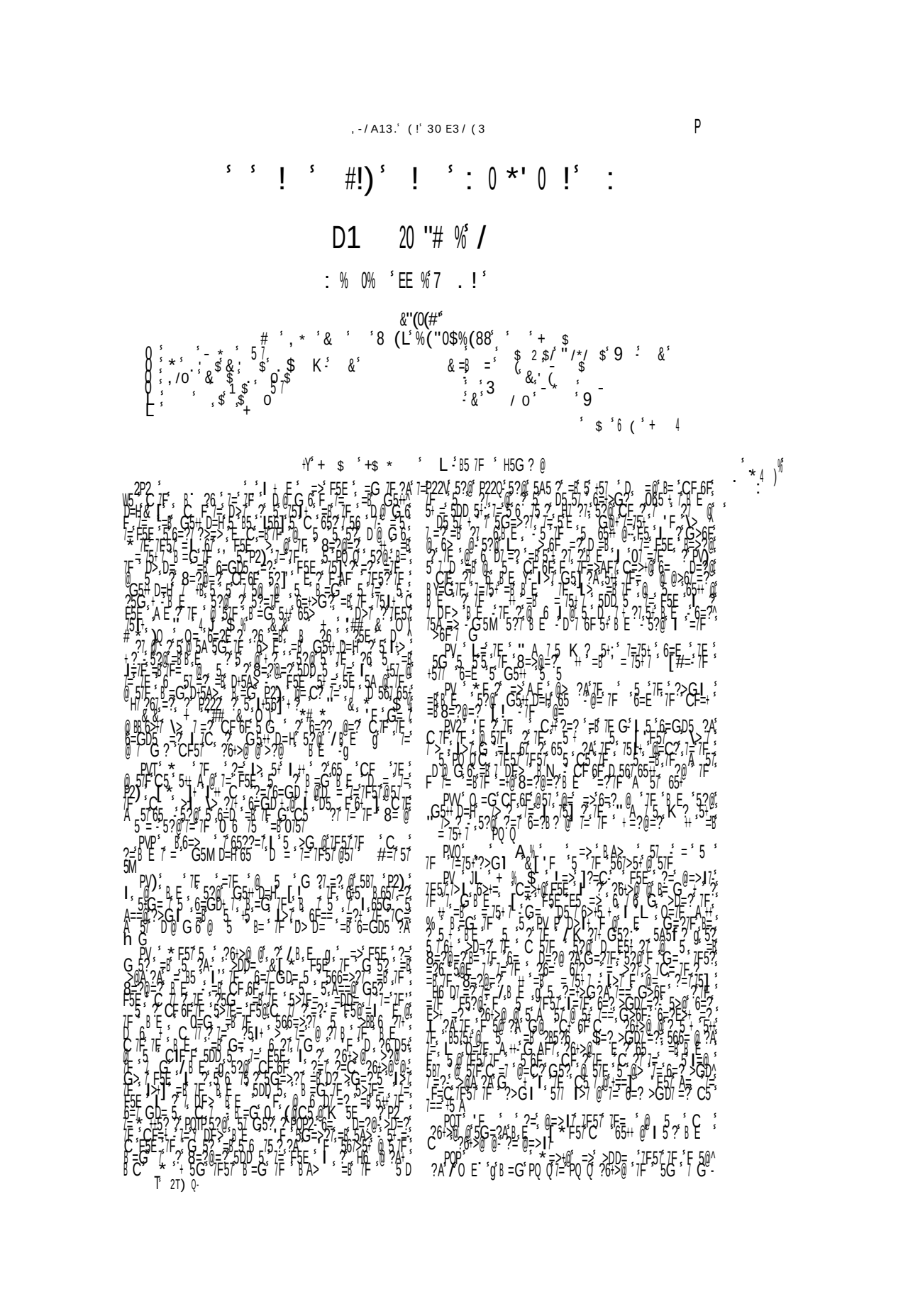

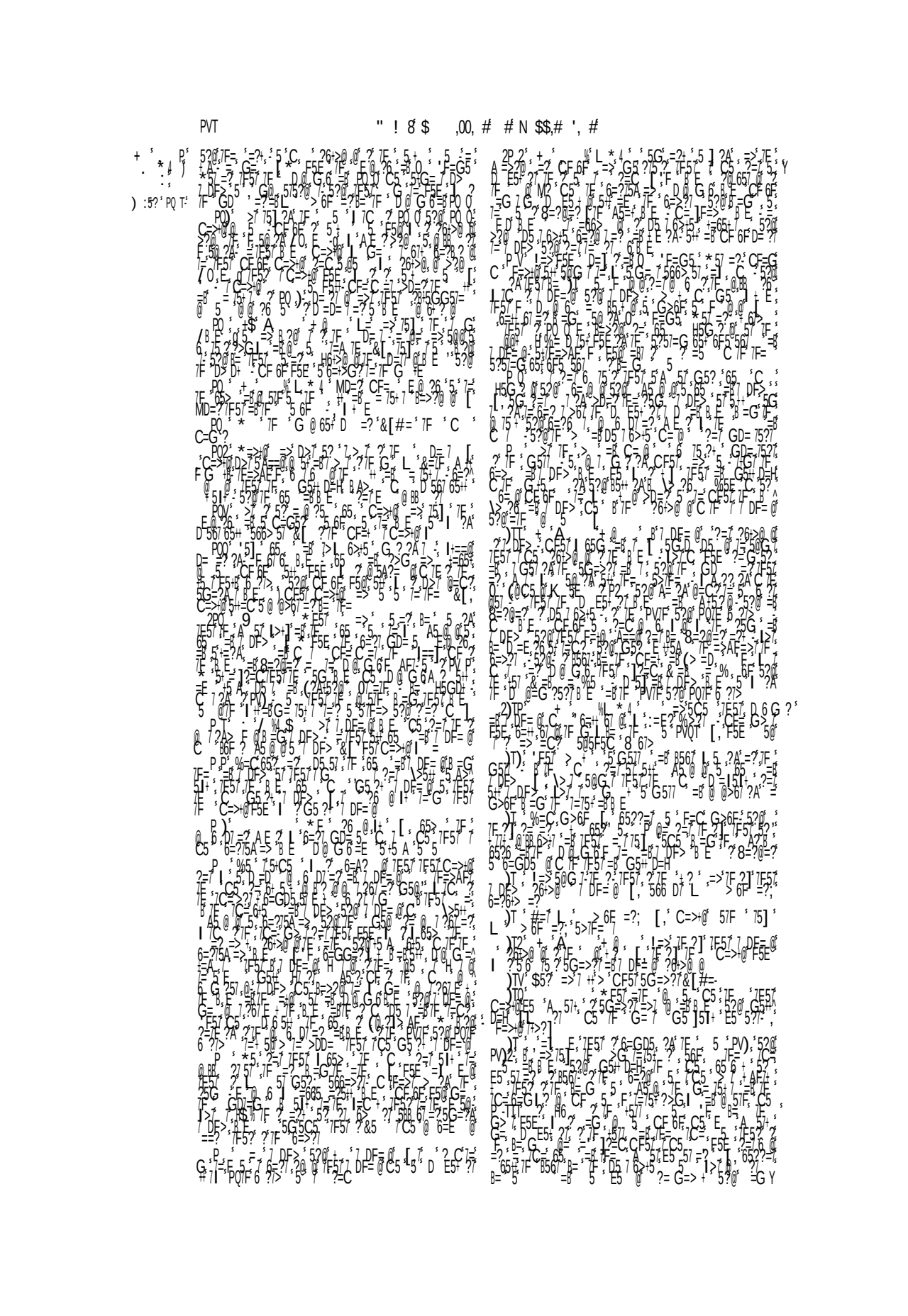

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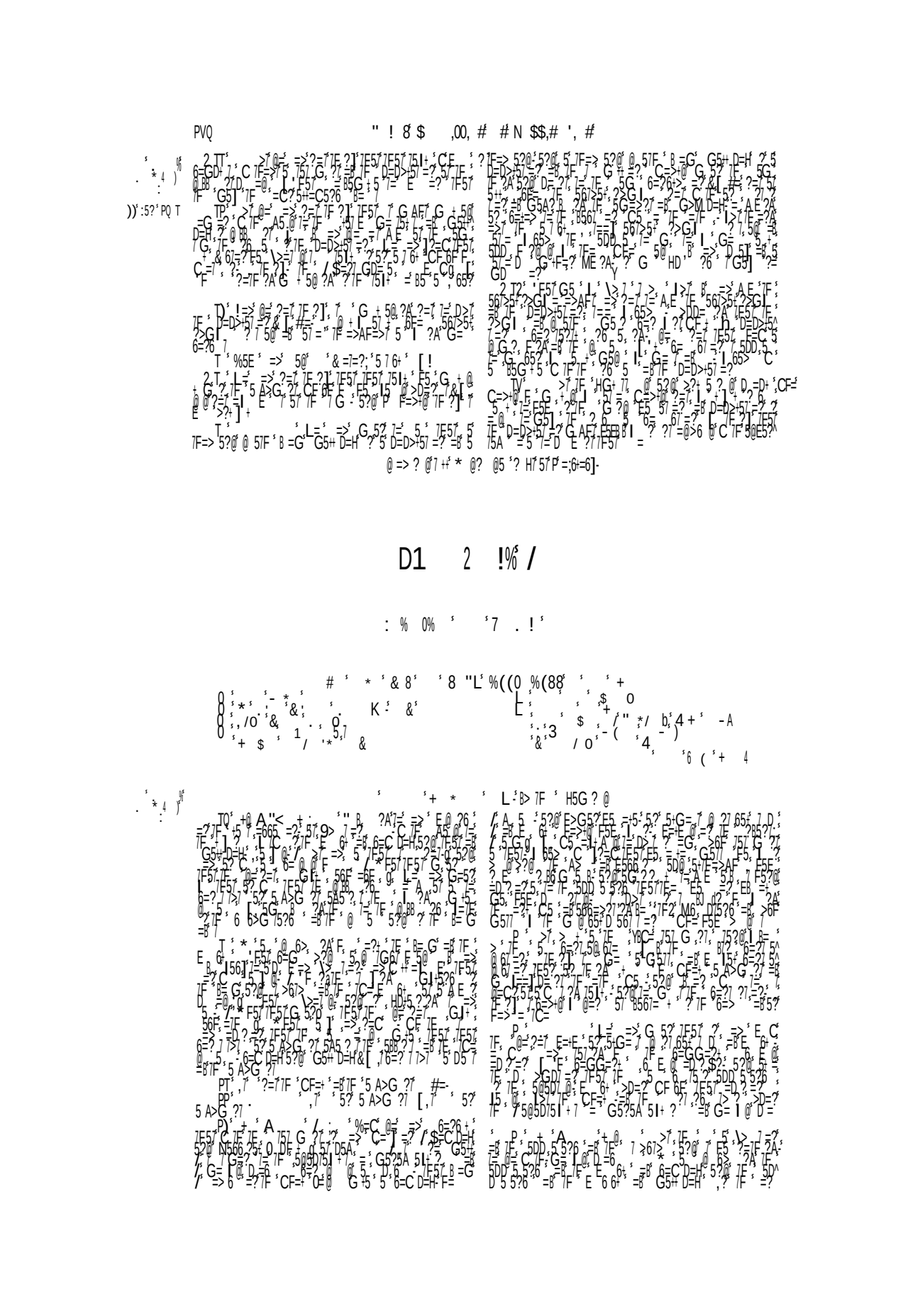

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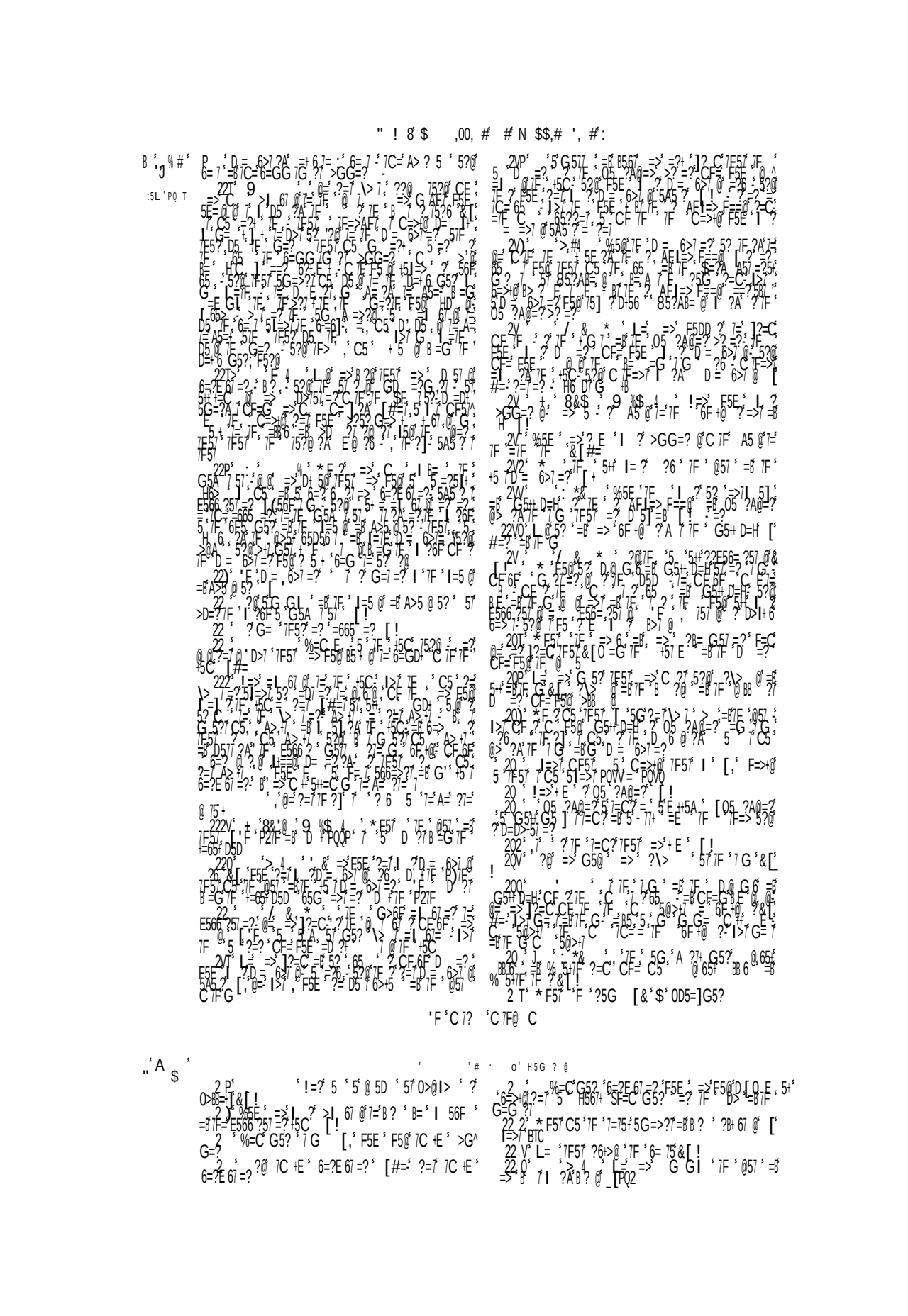

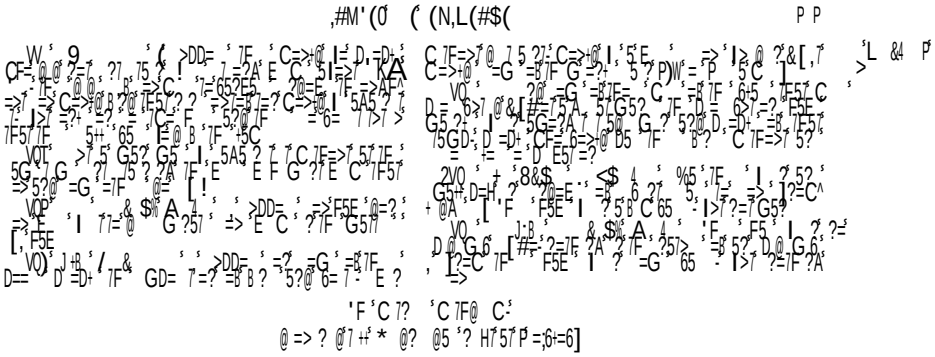

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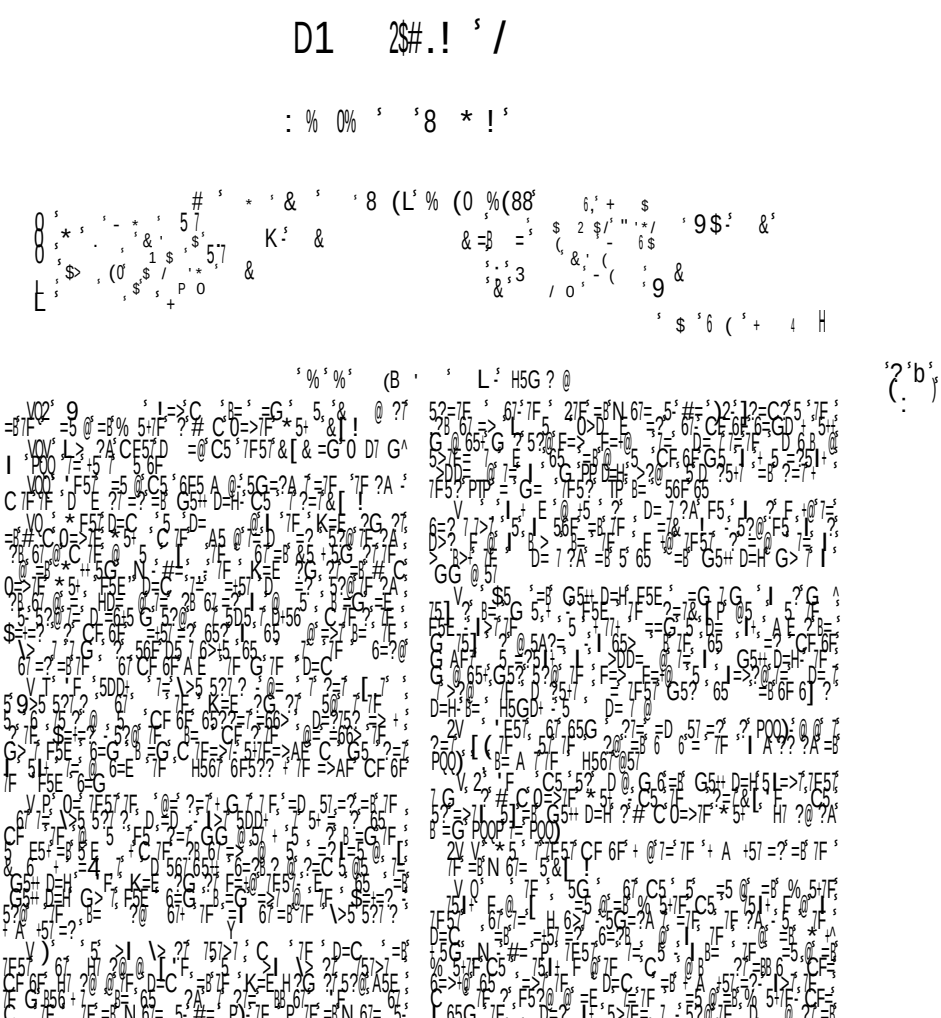

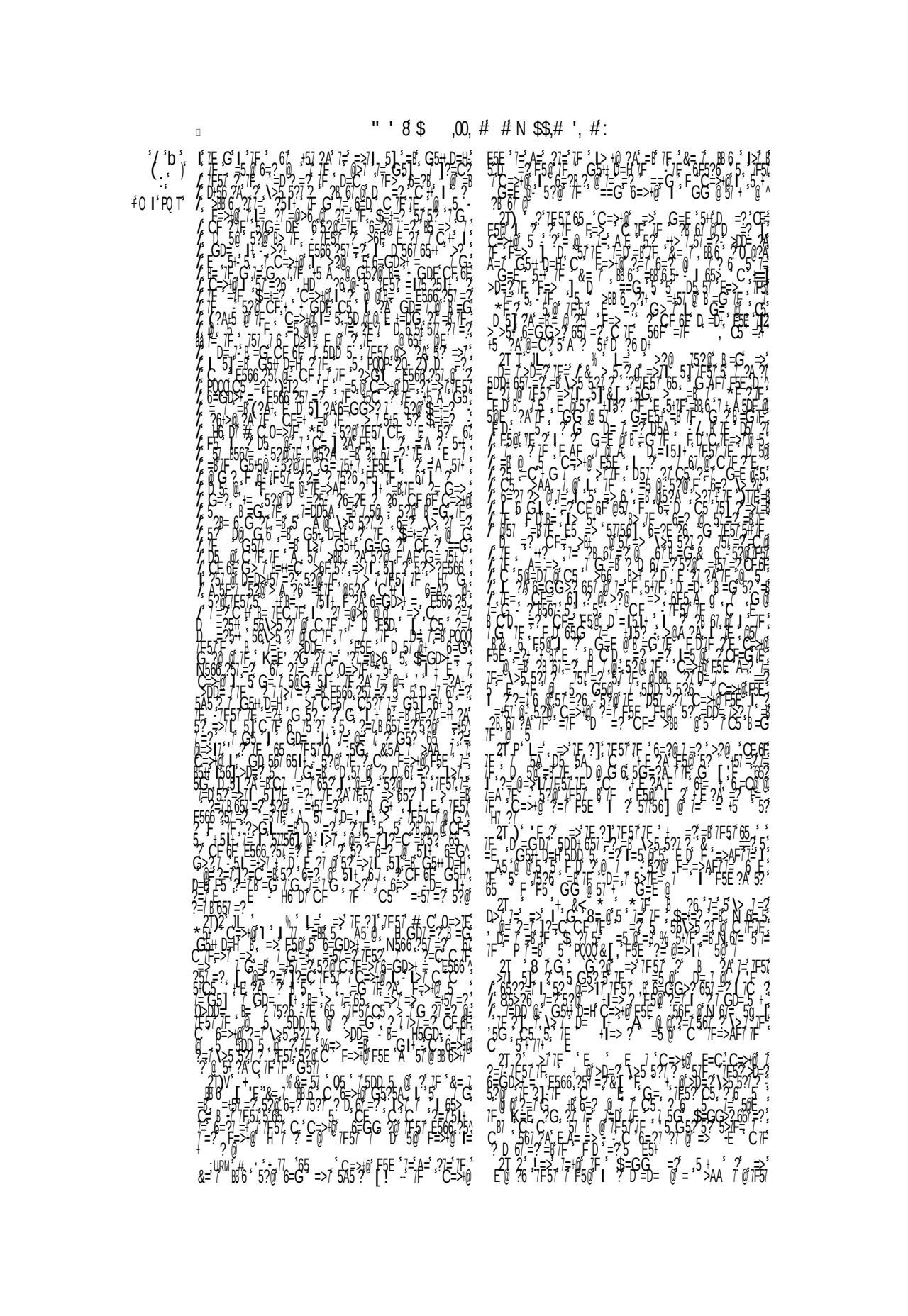

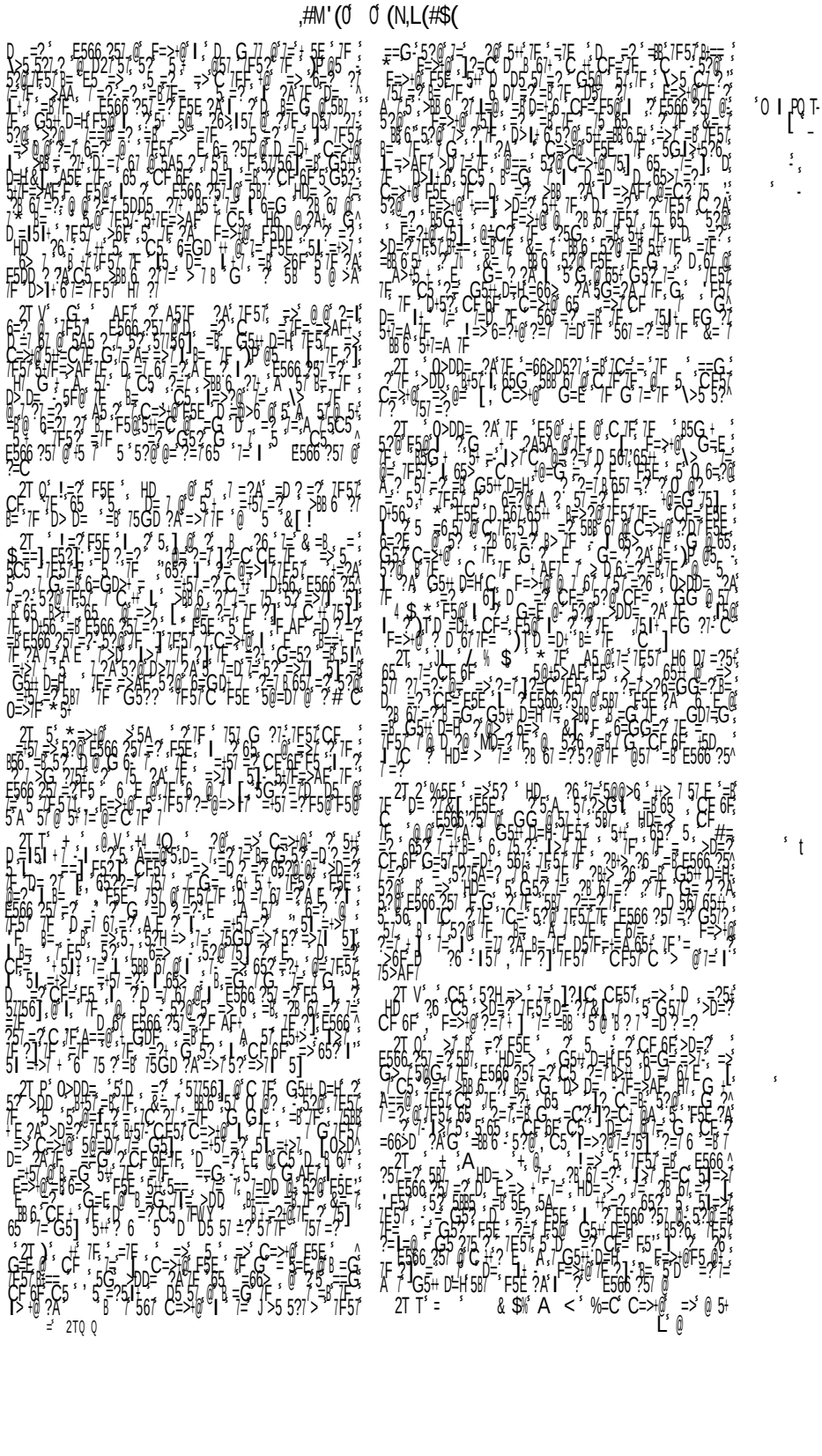

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I ' @ 7 ' [5@ 5 G ' CF 6F =?' E566 ?57 @ 7F57 ' => ' F5@ 5 ' 2PTP ' > %5E ' => ' F5@ 5? ' 6F +@ ?' E566 ?57 @ [F5E ' =?+ =? ' 6F +@
7F 6F +@ ?' 7F =>AF E566 ?57 =?- = ' CF =I + E @ 2PTJ ' 1 B ' & $% A 4 ' * 5 ' 7E ' =?+ 5 =?' ' => '
= A5F 7F57 CF 6F 7E ' => ' F5E ' 757 @ 5 ' 7E ' =?+ 5 =?' ' => '
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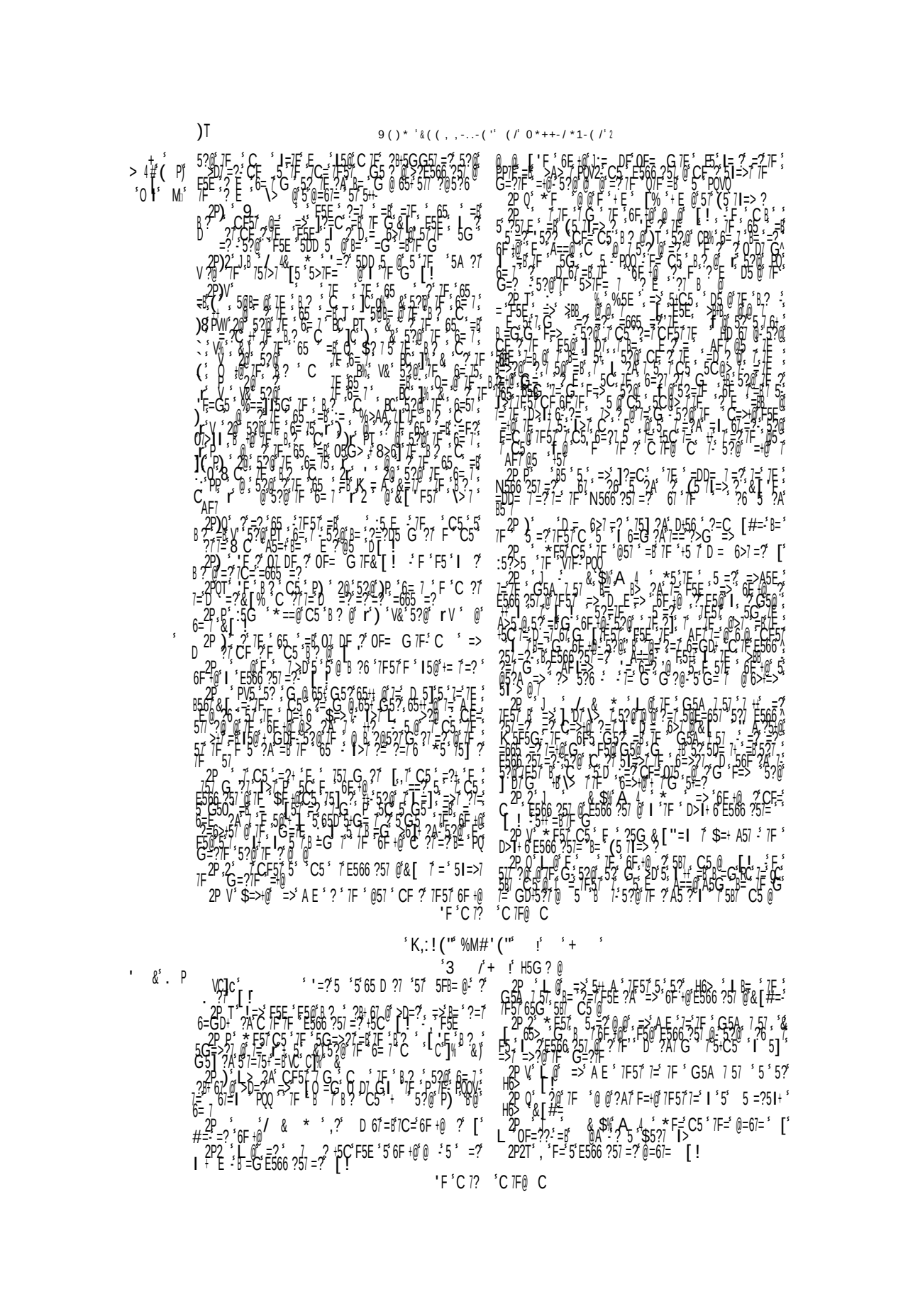

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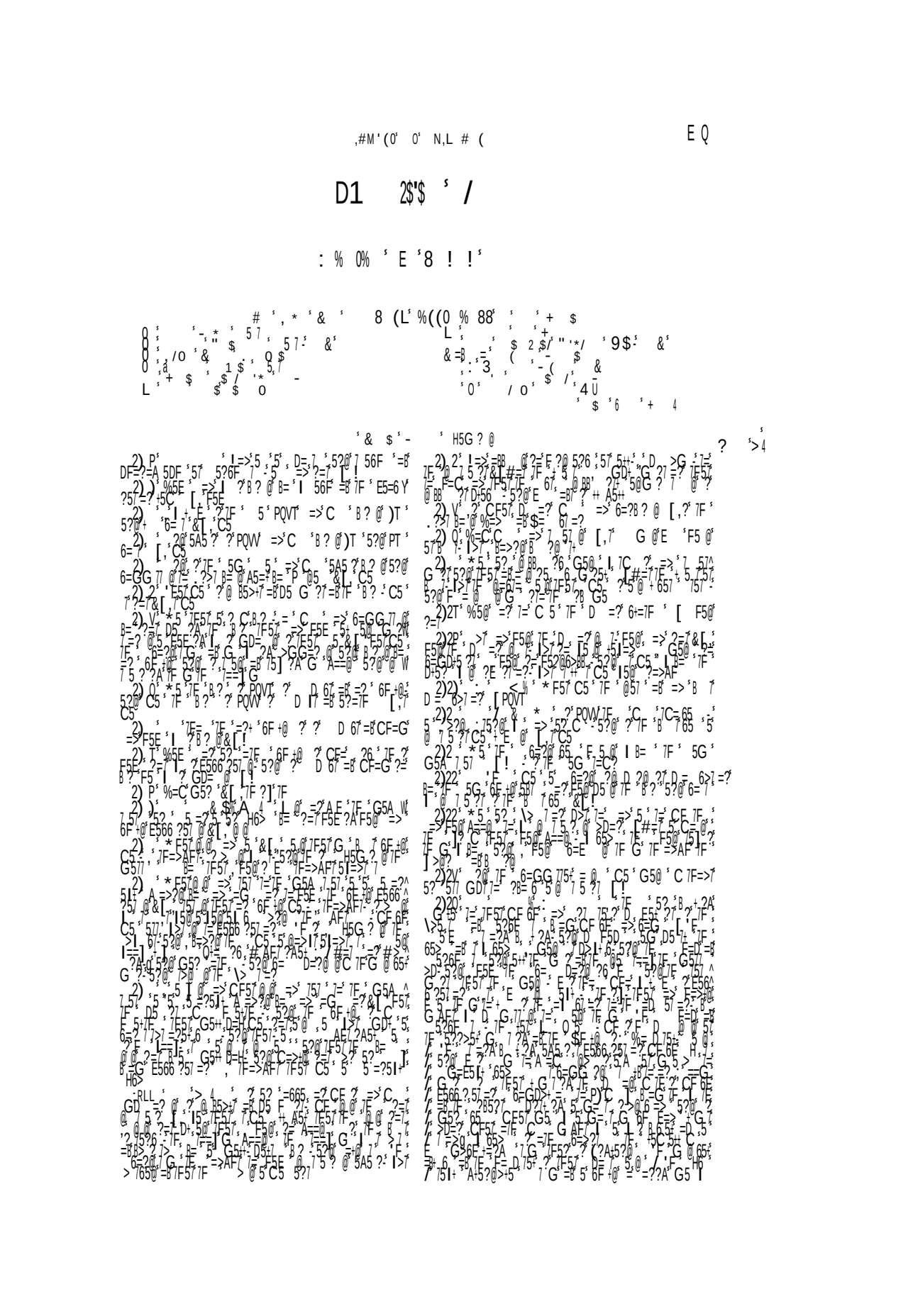

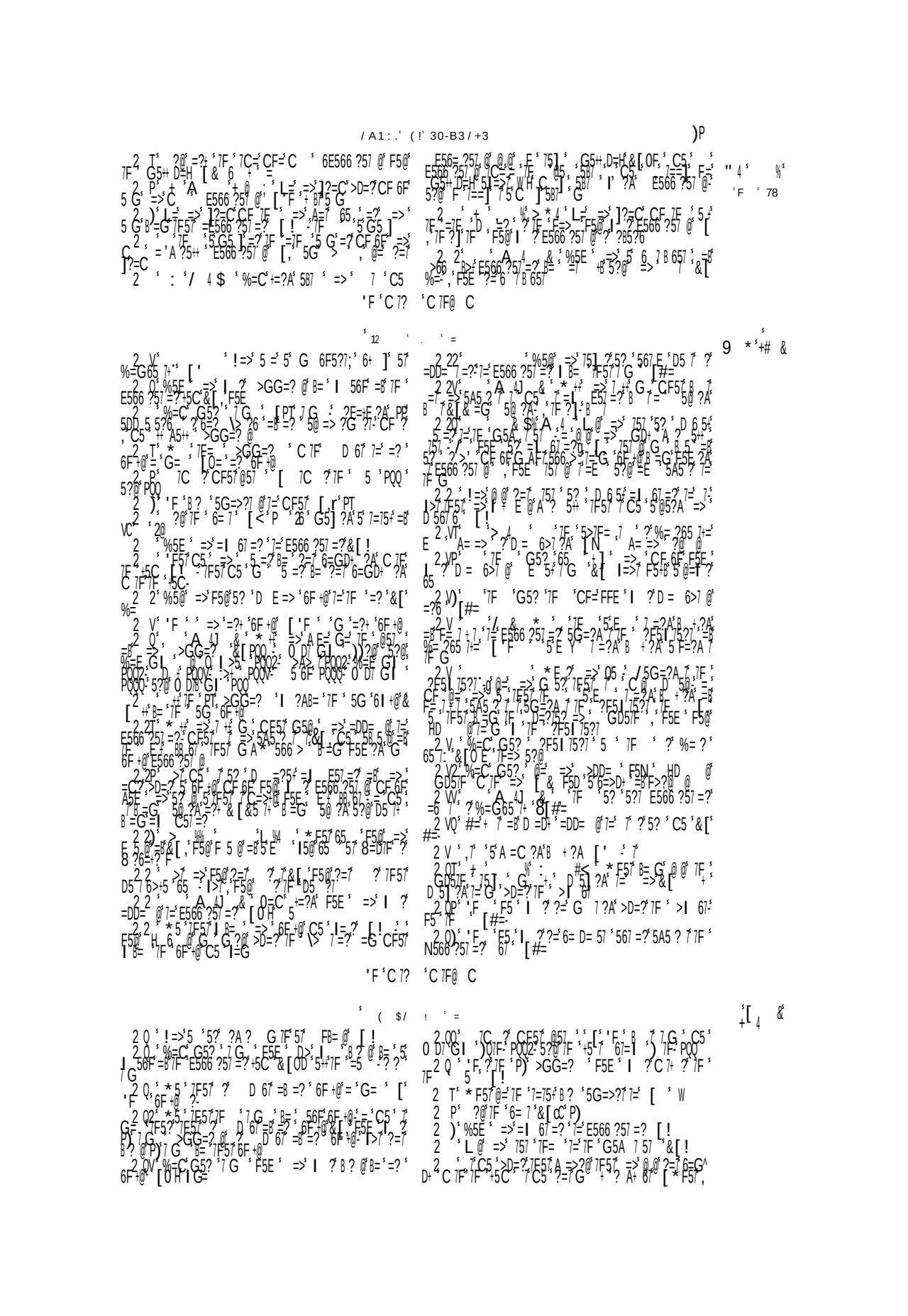

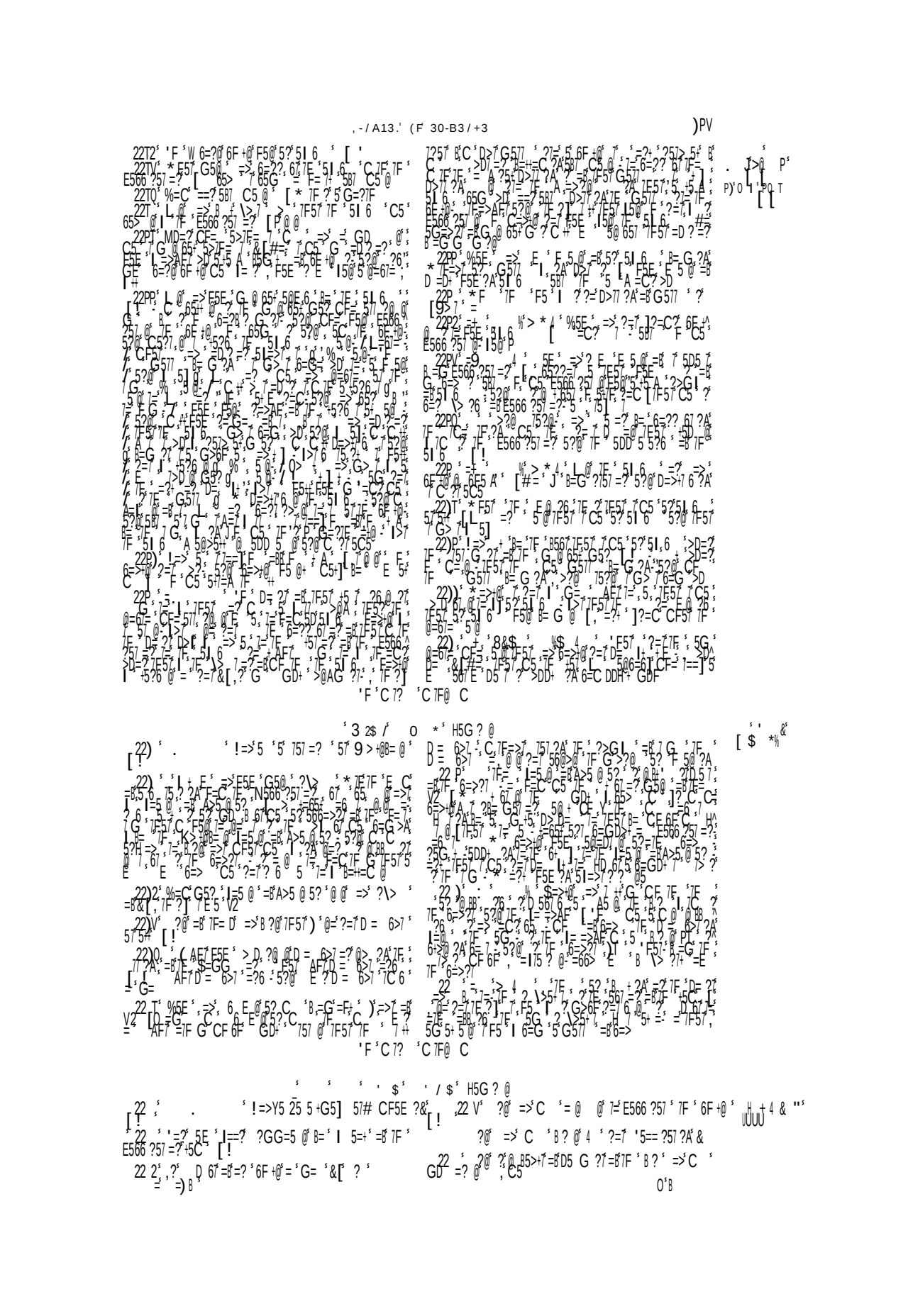

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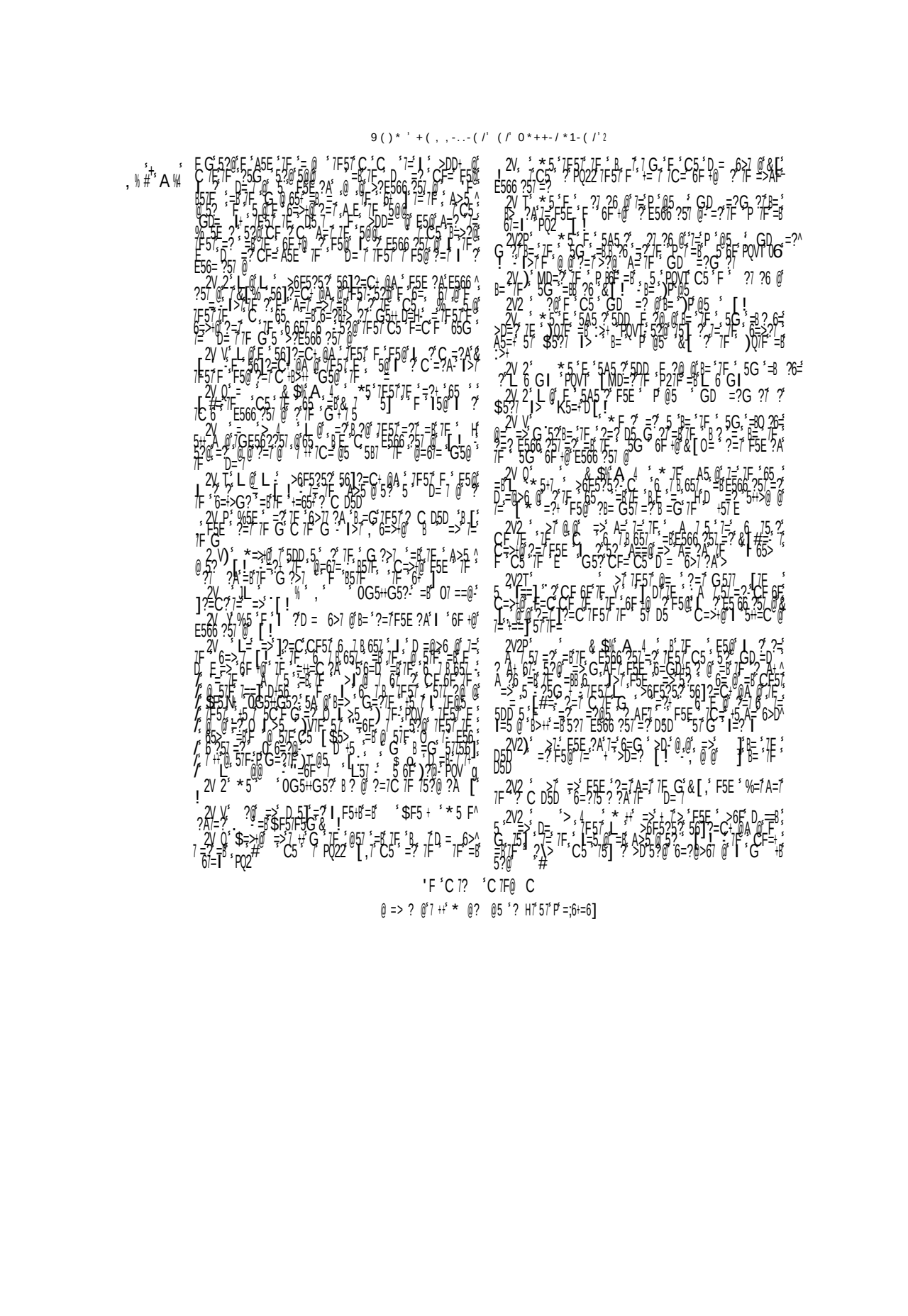

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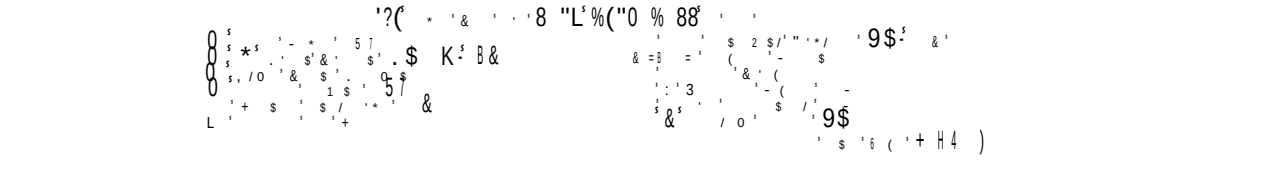
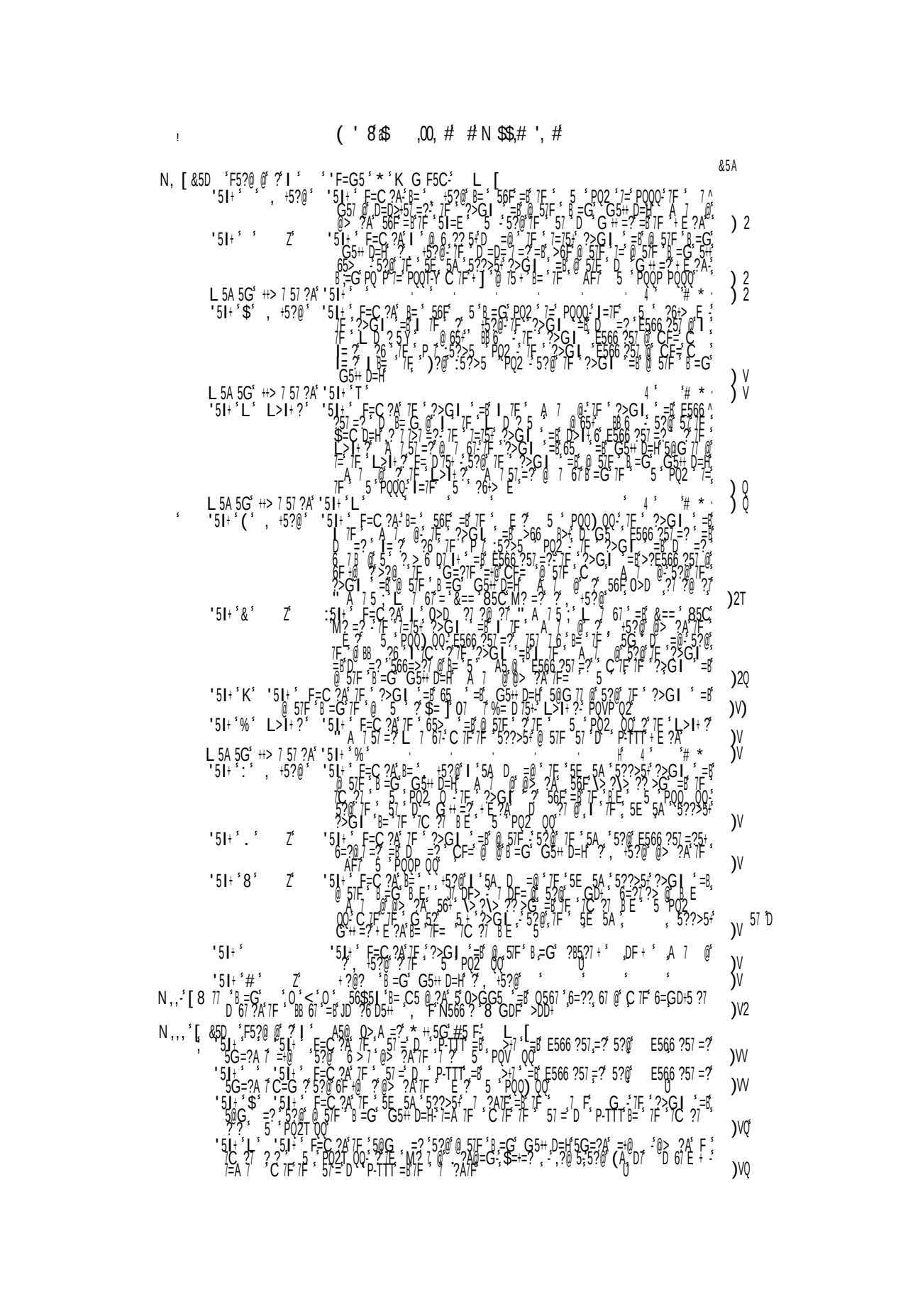
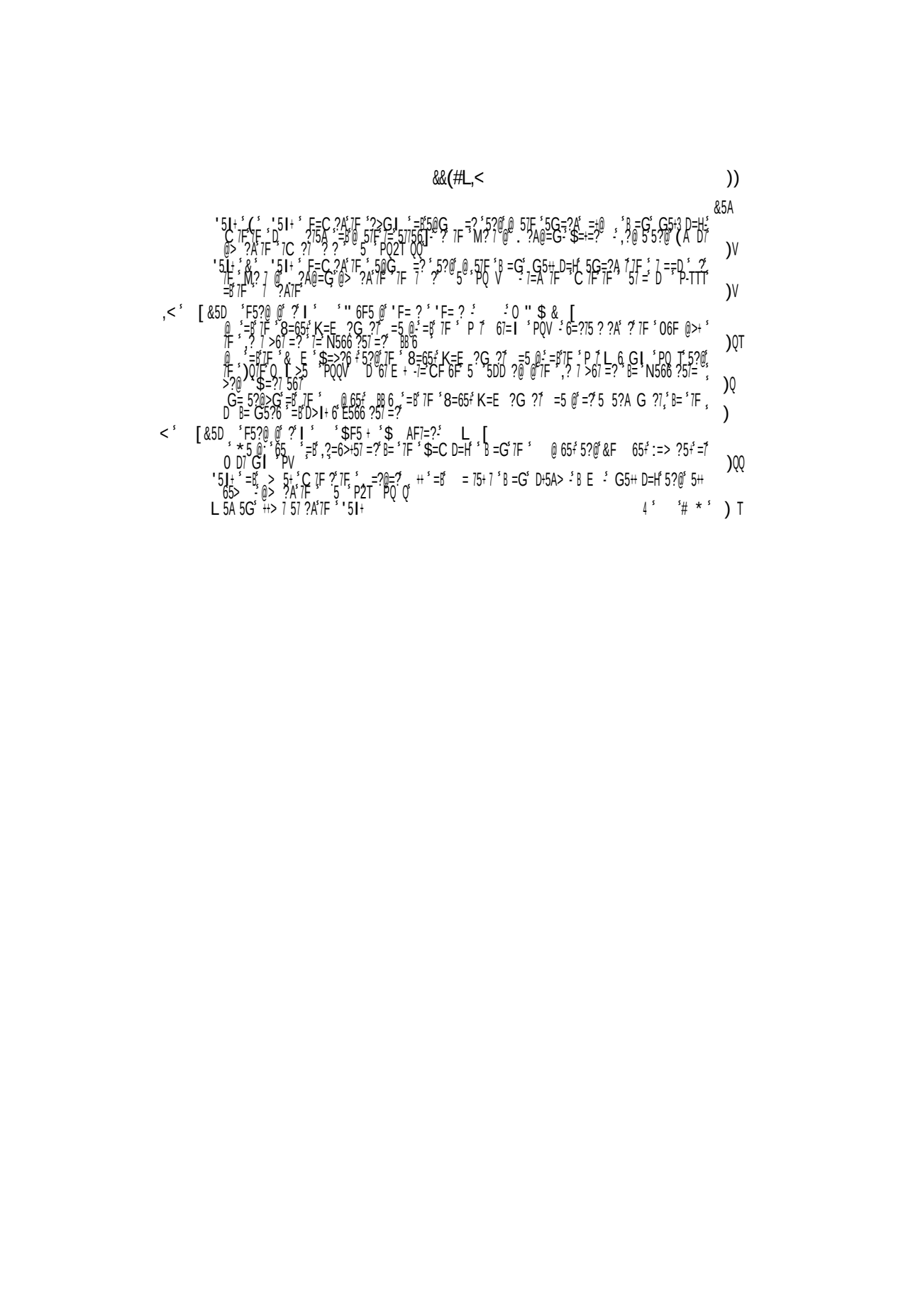






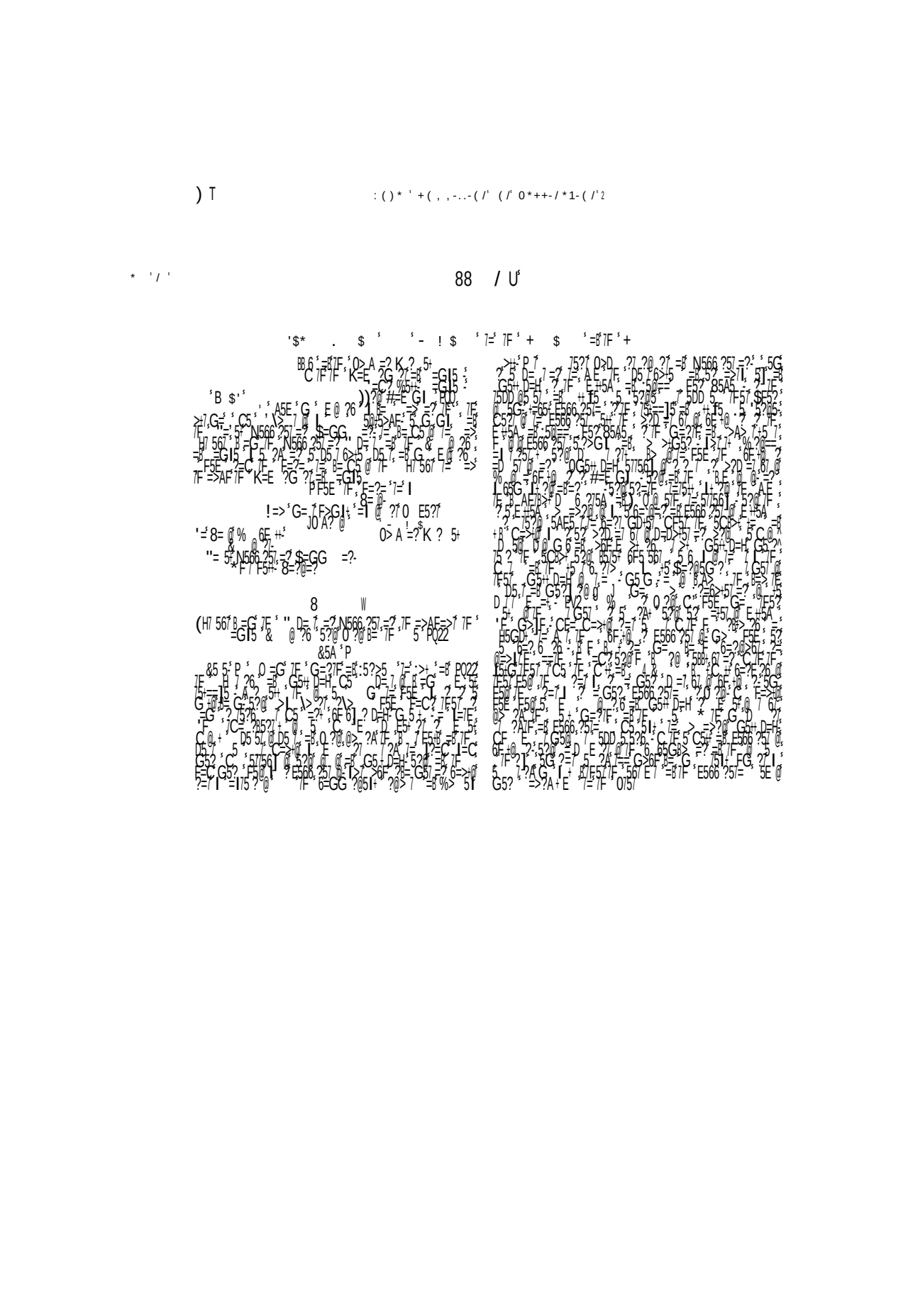
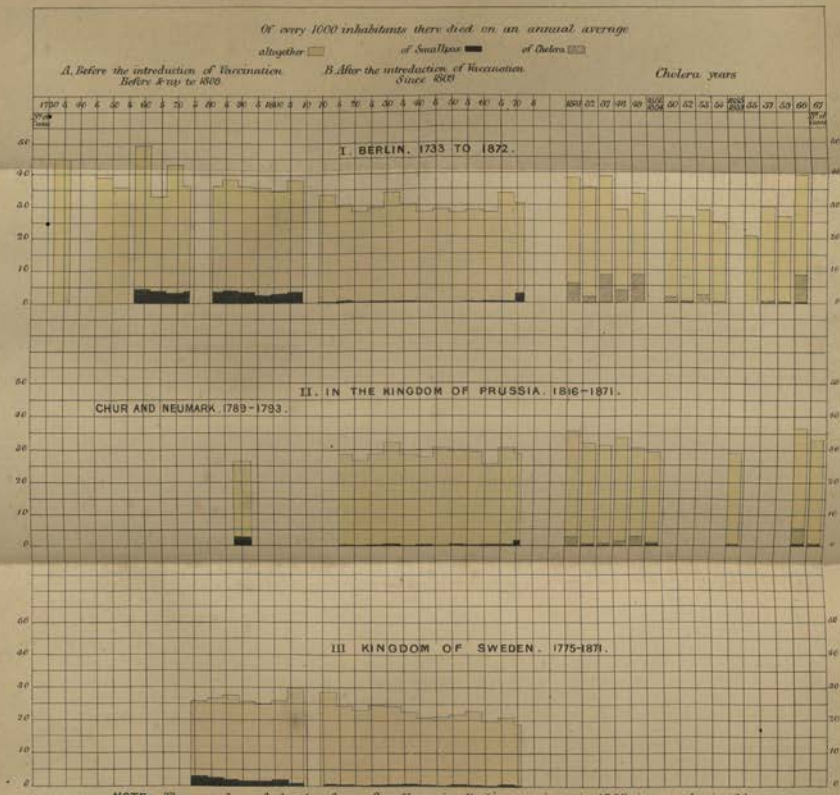


DIAGRAM *Shewing the Mortality from Small-pox (I) in BERLIN from 1732 to 1871, and (II and III.) in the kingdoms of PRUSSIA and SWEDEN from 1775 to 1871, compared with the general Mortality, and the Mortality from Cholera in Cholera years. After Guillstadt.)*


Of every 1000 inhabitants there died on an annual average
altogether
of Smallpox
of Cholera
A. Before the introduction of Vaccination. Before it up to 1800.
B. After the introduction of Vaccination. Since 1800
Cholera years
I. BERLIN. 1733 TO 1872.
II. IN THE KINGDOM OF PRUSSIA. 1816-1871.
CHUR AND NEUMARK. 1789-1793.
III KINGDOM OF SWEDEN. 1775-1871.

NOTE: *The number of deaths from Smallpox in Berlin previous to 1758 is not obtainable; the same is the case for the whole of Prussia before the introduction of Vaccination. The Mortality from Cholera in Sweden does not admit of comparison with that of Prussia.*

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PQ2Y' '	)P-Q2	PP- T	Q2	2 Y	PQ2Q' '	) - P	PT-V) Y	P- PV	Q2YQV
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0 G +5 +' 5 'B=+=C ' ' ?'PV T' % ' JP '5 I=E ' 7F'&5 7 'D ')QQ ' =?+ ' '=>7'=8'2 ' @ 57F 'C ' 7F= ' =8' 5@>+7 ' ' F 'B A> 'B=' ?7 I 5'B= '7F '5'
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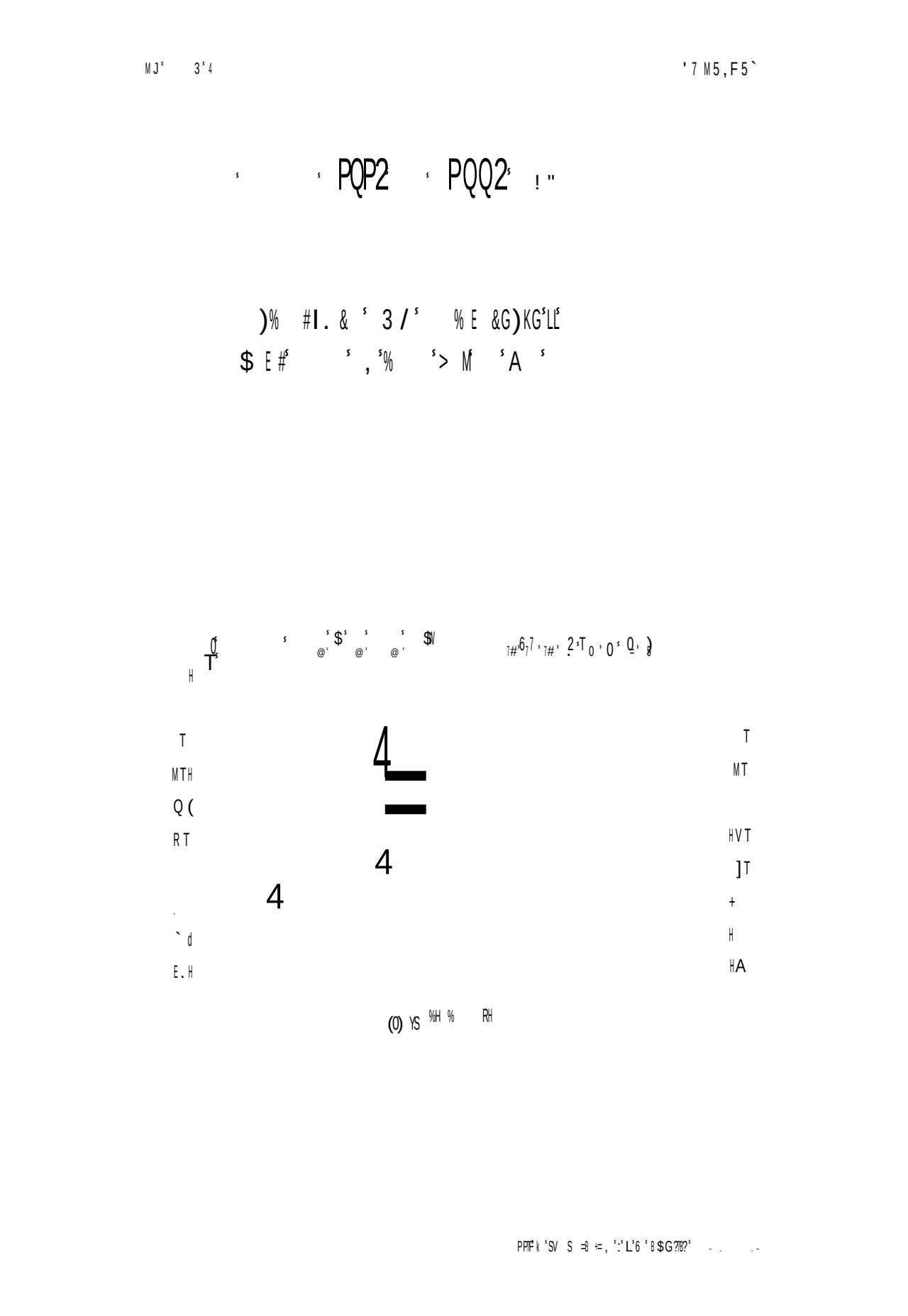

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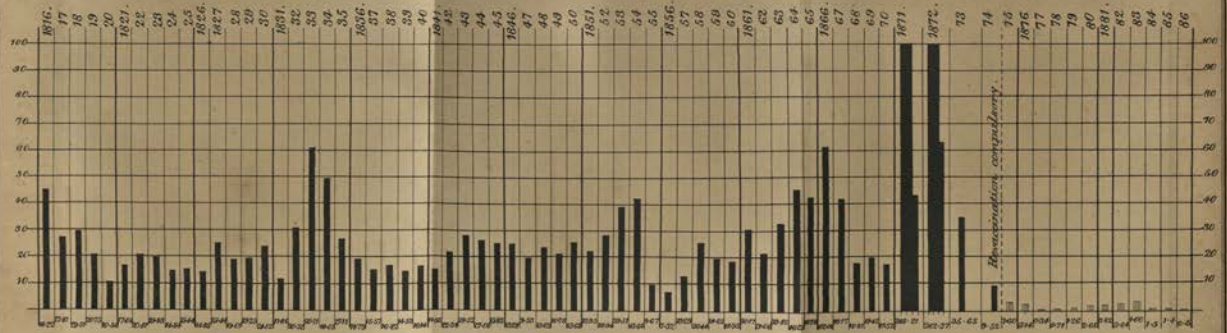
Diagram showing the mortality from Small-pox in Prussia from 1816 to 1886 per 100,000 Inhabitants.

(The figures from 1816 to 1882 are taken from Dr. M. Schultz's "Impfung, Impfgeschäft und Impftechnik" Berlin 1888; from 1883 to 1886 the diagram is drawn according to the figures given on page 149 of Vol. I. "Statistisches Handbuch für den Preussischen Staat" Berlin, 1888.)



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M?@ ' ' 5 ' _	)	T	5	&	P)	2		P	2Y
+ 7) ?@' Z	PPT		P)		)	Q	P	)	) YT
)?@ O @' Z	P)2	5	Q		Q	2	P2Q	Q	P Y2
O @ 7F' Z'	P V	)Q	)V	)	P		)T		P2Y2
7F O7F' Z	P V	PV	))	)	)V	2	PQ2	)2	P
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Z'		PP	)	2	PQ		P	PV	P)YV
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05 ?=C=' 5'7=C?'=5' & > 5-' Q 'GM ' =>7F' =5' &= ?

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Q7F' Z') 2 P PQ7F' Z' PV V) Q7F' P Q7F' ' Q)
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PT7F' Z' P2 VT PP)T7F' P2 2 :F' Z' _ P 2 2 a* 7F' Z' P)
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)?@' Z' _ P 2 2)?@' Z') P 2)?@' Z') V)?@' Z'
@' V P O @' Z' P 2 @' Z' _) VQ @ P R ,
7I' _ 7F' Z' Q 2 7F' -' _ P V 7F' Z' -
27F' Z') 7F' Z') 2 7F' Z' V27F' Z'
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V7F' Z' P V7F' --' 2V7F' Z' P VV7F' Z'
Q7F' Z' _ 2Q7F' Z') P 2Q7F' Z' VQ7F' -'
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P 7' Z YTV Y VP QT TYTT TYTT

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' QY2P PYQ PP') Y V Y P
Z' _ P2Y Q Y2 PY')YV 2VY)V
Z' _ P Y)) Q YVQ P ' PY2Q 2QY')
V' S TY2V 2 Y P ' 2TYQV Q Y%

B'7F 'V2 '65 '5G=?A 7'E566 ?57 @' ?@ E @>5+ -'QO '= ' Y 'D '6 ?7 -'C '@ 6 I @'5 'E ' + AF7

% F')

' K DD' #=')

' O *' ' P' 2 ' P' ' ' ' # O ' , O (Z' O ' /' O ' M(#='
'%(' ' / (' ' PV 2' /' ' B O ' C (' ' PQ22 2V' - ' 7 ((' *' '
'%(8 ''((,#0' #$(

" ' * %' ' / $ 7)' / ; $)' &' + $ ' ' 4 P ' ' (47)' I'> P ' &' F 4 0' / %)' POOT-'
4 ' , P 1' 4 %' ' ($' ' L ' ' 4 ' I' ` 4% 4' & %' - *' / ' /4 4' / 4)0' , * *' EF)'
PQV)-' * *' 2

(5C 6f-' = 5?=C=-'05 ?=C=' P -Q) ' ?F5I 75?7 8=E ' O 5?6=? 5 ' I=>7' TT-TTT' ?855I +??7

A	PV 2' 2			PQ22 2V		
	$5	L 57F	& ' 6 ?7	$5	L 57F	& ' 6 ?7
& ' 5		M	2	V	)2	V
)PT' Z	P-P 2	PQ)	P2 Q	)		
PP)T' Z	2	0		PPT	P	T;
T)T' Z	P-)2)	P	P2Y	)PT	)V	,0'? 5 +
T 2T	L	/		P-	P	PTQ

0G5+ D=f' G= 75+ 7 ' D ' TT-TTT' ?' 7F ' 7F ' 7=C? ' 5C 6f-' = 5?=C=-'5?@'05G=C= ?' PV 2' J?=' E5 ,6 ?57 =? '
L=' @=' ?' 8=C ' & 5?6=? 5' ?' PQ22 2V' J ' 566 ?57 =? ' _ _

' &

' O *' ' " ' ' 1 ' ' ' 1 ' , / (' " ' ' PQ V Q' +=' PQ2 VT'
` 4% 4' & ' - ' / ' +4 4' / @)' , * *' EF)' PQV)-' # ' P

				L 57F		
! 5	'=75' #>G I ' =8 L 57F	0G57+ D=f	5 + ' 5?@' (7F ?	065 + 7' O E	%==D ?A 6=>AF	' DF= @
:Q2V Q	P 2-T2	P2	V Q	P Q	- V	-2 P
PQ Q	P V 2)	P2T	P- T2	P-Q T	-P	- QQ
PQ 2T'	P))- P2	PQP	Q	P- V	)- QV	-V22
PQ2T 2P	P V-QVP	V	P-	P-T P	Q- VP	) 2
PQ2P 2)'	P V-P)Y	P)P	P V2	)-)TP	-P	-)P)
PQ2) 2 '	P P-PQ	PPP	QQ	TT	-)T	Q- P
E 5A	P - 2	P T	PPT)	P-Q	-2P)	-T T
& ' PT-TTT' @ 57F		PP	QP	P T	)	)
PQ2Q 2	P V-)	PT	QT	) 2	Q)T	-
PQ2 22	P2 - QQ	))P	Q)	P-2QT	)-V T	-2T
PQ 22'	P2P- P2	VV	)-TQ2	P-) 2	-P T	-)
PQ22 2V'	P V- T	P)PT		P-P	-T	)-Q
PQ2V 2Q'	P -PQP	PV	Q P	)-Q 2	Q-P V	)-V P
PQ2 2 '	P2 Q2	QV	Q	2-P2V	B C]])	-P
E 5A	P2)-)	QV	P-TQ	)- P	-)T2	- V
& ' PT-TTT' @ 57F		Q	V)	P2V	-)PP	)P
PQ2 VT' _	P Q-2)	2	P-TP	-Q V	)-QP	)-Q)
& ' PT-TTT' @ 57F		)	2	) 2	PVV	PV
K ? 5+' 5E 5A	-' P - V	2Q	P-T	)-)QT	Q OPV	
& ' PT-TTT' @ 57F		)	V	P2V	))	) T

EF

F3B' (' %' 73++6%3#6 %'

DD'#=')'

'

: : ' # ' o H' ' " ' " ' P' ' ' 1 $ ' ' . 1 ' " ' ' 1 ' '

F $ ' PQ2V VT

` 4% 4'& %' - *' / % '+4 4' /@)', * *'OF)'PQV)'#')

' 5 P I I5 G B @ I5 G &B5+f I DB5+f I B 5?] ? 77 +B 5?] ? M?7= B 5?] ? O6FC5I ? .@? A =F

PQ V Q'_	Q	)Q	PQ	V	PQQ	Q	P2	)2	QP2
PQ Q 2	PQ	PV	P)	PV		Q	PP	Q	P2T
PQ 2T	2	PT	)	)	Q	QQ	PP		P P
PQ T 2P'	V	PT		QP	2	2		2	VO
PQ2P 2O'	)	PT	)2	)	)P	)T	P)		P)P
PQ2 2 '	]	Q	)	P		)	)	PV	PPP
PQ2 2	QV	PP	P	P)	P2			)	PTQ
PQ2 2	2T	2	Q	P2	P		2		))P
PQ2 22'	V)	P2V	P	PVP	VW	V		V	2VW
PQ22 2V'	T2	P	PQ	)	P))	2V	P	P2T	P-)PT
PQ2V 2Q'	P)	)22		P)	T	P2P	V	2	PV
PQ2Q 2 '	)	2V		PT	))	V	Q	V	QV
PQ2T VT	QT	P2	PPV	2	)	)V	Q2	P	2
'=75+	QT	V V		QV2			2		-VQ
! 5 + '5E 5A	2)	2P	T	2V				Q	2Q
& B=G 5+' P' 65>	5	Q	P	)	0	P	)P	PQ	)

$=GD>+,= 'D G5 ' E566 257 =?' F5 ' I ?'7F '+5C'=B' 5E5 5' ?6 'PQTV' ?'7F ' 5 + 'D =@'5+'6F +@ ?' F5@' 7=' I 'D ?7 @' B= 'E566 ?57 =?'

I B= 7F '7 G ?57 =?'=B7F 7F @' 5 '=B'+B

'

' o *' ' " ' $ ' P' ' 1 $ ' ' @MS@' /' @MSR' (/' (($/ *' '

` X '&' - ' / '+4 4' /$ U)', * *'F)'PQV -'D')P2

A ' ?	PQVP			PQV)			PQV'5?@' 7=A 7F		& 6 ?75A	
		&	'=75+		F	'=75+		PQVP	PQV)	'=A 7F
7' 5	2	QV	V	)2Q	)2)	2)T	P-)2	P V	PV;	P2 V
)	2Q	2	PQV			2V	)T	)YV	)Y)	) 2
2 PT' Z	P		Q	P)	P)	)	V)	T	TYQ	TY
PP)T' Z	T	-' Q)	PV)	)	)Q	2V	))		P	)YQ
)P QT' Z	)Q	) P	2P	PT	P)	)	Q2	P))	QY)	PTYV
QP T' Z	P	QQV	VT2	P2	)P)	V	P-TQP	P Y	P)	PQY
P 2T' Z	V	P	Q Q	))	)V	2)	P- 2	P2Y	PVY2	P2Y
P 2T' -	P	P	T	2	)PQ	2	P- 2	PVY	PQY	PQY)
2P VT' Z		QT2	VT	)2Q	)PQ	Q2	P-P P	P	P2Y)	P YQ
VP QT' Z	PT	QT	PQ	V)	P	P)	TV	QY2	P	Q
QP'5?@'=E '			P			2	P	T	T)	TY
	)-2	)- QP	-TVT	P-2	P-	)-)	Q-T2)	PTT	PTT	PTT

' B

' o *' $' ' F $ ' @MS@ ST' ' $ ' $ ' P' ' -$' ' $' @UU UUU' 6

,; 47)' I' / " '$ &' N @ < Y'#' QQ' ' 4 '^ <%4 &4

,?'7F ' ! 5

	PQVP	PQV)	PQV	PQV -
,?'7F ' +@'& =E 26 '@ 4'$=GD77+ = ' N566 ?57 =?				
P'& > 5	))	T	QT	PQ
)' 5?@ ?I> A' _ ' ' ' _	Q T	)Q)	)	2
'&=G 5? 5'	)QV	)	P2	0
'&= ?'		2Q)	P)Q	)
2'0 + 5'	)P	Q)P	2	)P
2'05H=?' '	)W	PV2	7'	Q
V' * 7DF5+ 5'	)22	)T	P	)
Q' "F ? +5?@'5?@'%=F ?f=M G	)2	PT2	2	

) T ' (' ' 1 ((' 9

DD' #= # ' %

' 0% 'M# ' ' (* ' ' " ' ' P' *' 7 ((/' /' E A1 ((/' ' 1

&8 $(0' ,#' L,0&((#"' !(:$0

L '4 ' ` 4% 4'& %' - & * ' > %% '+4 4 ' / @ 4 ' , * *' O EEE)' # ' P22

D+56

& 5?6 '
5 ++ ' '
* > 7 ? I>? '
S
$5?7=?' =8' * 55@7'
=F G 5'
+5?' ' ' S'
N =?5'
+5>'
$=D ?F5B8 ?
??5-' %= D 7 '
-' ' ' _
& 5A> ' $F +@ ?; ' %= D 75+
8=?@=?-' 0G5++ D=H' %= D 75+

' W' "

' ' S
' S' S' _
&=+5?@'
0 G]8= 7-' '=C?'
' W' ' '
Z' K=E ?G ?7' P' L 7 67
8 E D==+' 0G5+8D=H' %= D 75+'
+ ?-' 8555 77='
$=I+ ?7f'

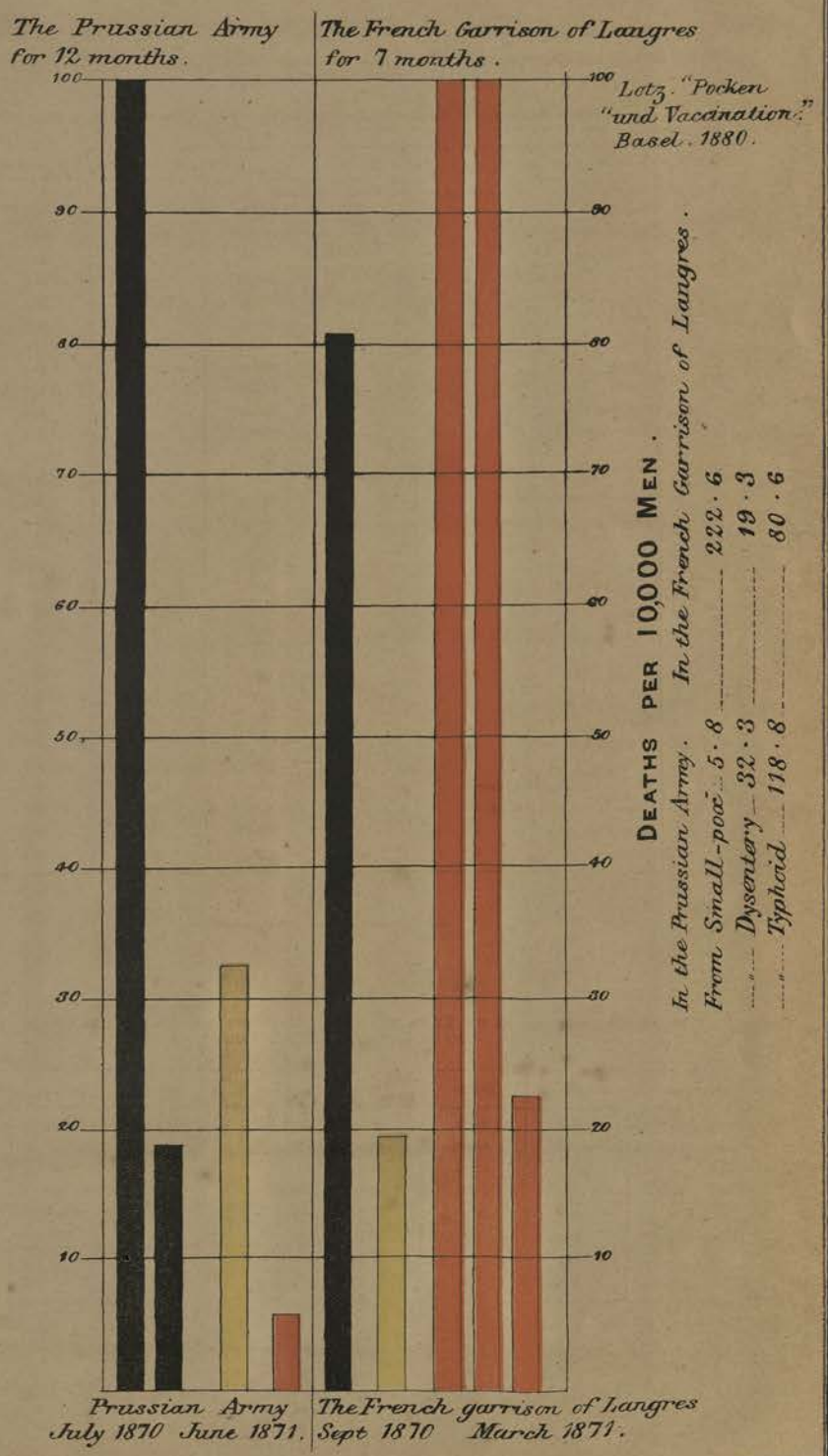
! 5	Q=' E ' PTT' N566 ?57 @	Q=' E ' PTT' <:?E566 ?57 @
PQP2 P	PYT	P2Y)
PQ)Q	PYT	')2YT
PQ P 2	VYP	)VYQ
PQ T 2T	Y	QY
PQ))	)YP	) YT
PQ 2 22	YP	) YQ
PQ T P	VY2	QQY
PQ) Q	YQ	2Y2
PQ P	)YP' _	YQ
PQ)Q V	PYT	)VY2
PQ V 2	2YT	0 ;
PQ2	YQ	PQYQ
PQVT	0	PVY
PQ T 2Q	QYT	)YT
PQ Q 22	VYT	YT
PQ2	P)YT	QYT
P 2	QYV	2YT
PQ22	VY	QQYT
PQ22	VYQ	YV
PQ2V	QY)	2YQ
PQ2Q	2Y)	Q YT
PQVT	VY	QY2
PQVP	P Y	22Y2
PQVP	MY P	Q)Y
PQVP	P2YT	YT
PQV)	P2Y2	2YT
PQVP	P YQ	YQ2
PQVT	P)YVQ	V)YT
PQVP V)	P YTV	QPY)
PQVP	PQYT	2YQ

'

' 0 * ' ' (' ' ' F ' PQVT Q -' ' ' ' ' P' ' ' ' B / '
3%"' 6%' 7 ' s' PTT-TTT' 6

! 5	+ ?	8=?@=?	N ??5	! 5	+ ?	8=?@=?	N ??5
PQVT	))Y V	QTY)T	2YVP	PQVQ	TYVQ	QQYQP	V2Y P
P2VP	2)Y22	))YP2	V Y T	PQ ' ' _	TYV2	P)YP	2Y P
PQV)	PQQY2P	YQT	2Q2Y Q	PQQT	TYQP	P)Y2T	V Y2)
PQV	PPY)P	QY	))QY T	PQQP	YV	2PY P	P) Y
PQV	) YW	PY22	P 2Y)2	PQQ)	TY	PPYTV	PTQY)T
PQV	2YP	PYQ)	PP Y T	PQQ	TYQ	YTT	Y2
PQV2	PYQP	)TY2T	P2VYQT	E 5A '8=' 2 ?			
PQVV	TY T	VTY Q	Q YTP	C ' 8=G ' -')QV Q	PYV	) YQ	Q Y)

DIAGRAM *showing the death-rate per 10,000 from Typhoid (black) Dysentery (yellow) Small-pox (red) amongst*



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PQ P	P - QT			PSQ	VYZT		PY)
PQ)	P - QT			2	2Y2V		0Y
PQ	P -T T			PTQ	VY T		TYT
PQ	PQ -Q2)	2P	VW	Q	)YQP	2 P	Y
PQ	P 2- 2)	)	P P	H	TYQV	PY	)YV
PQ 2	PQT- T2	,0	Y Q		TY2	2Y)	PY
PQ0'	P)2-) P		VY -		TY)	QYP	PY2
PQ Q	P)2-)	PPP	QW	V	TY	2Y P	PW
PQ	P) -T)	Q	2Y T	)	TYP	)Y)2	PY
PQ T	P)V- P	V	YQP	)	TYP2	)YVT	PY2
PQ P	P)V P	2	Y2		TY)	YTQ	PY
PQ)-	P)V- 2P		VW	Q	TYP2	)YT)	)Y)
PQ	P)V- P	P2V	P YPT		TY)	PYQT	)YQ
PQ	P)V- P	2	Y P		TY)		5W
PQ	P)V- QT	0	)Y	P	TYTQ	QY Q	PY2
PQ 2	P)2-P2	T	)YQQ	P	TYTQ	Y	PY2
PQ V	P)2- P		TY				TY
PQ Q	P)V-TT	))	PW	P	TYTQ	Y2	PY
PQ	P)Q-T))	2)	2YT	P	TYTQ	PY2P	PYP
PQ T	P) -T))	PV2	P Y P	P	TYTQ	TY2V	PY2
PQ P	P T-2)	) 2	PQYQ		TY)	PY))	PY
PQ Q	P T 2)	QV	2Y22	P	TYTQ	PYP	PY
P 2	P P-)	P Q	PTY	P	T T	TYV)	Y
PQ2	P P-2)	P)P	YP		TY)	)Y Q :	Y
PQ22	P P-2)	+)	TY P				TY
PQ22	PQP VTQ	)P	PY				TW
PQ2V	P)-	Q2	)Y 2	P	TYTV	)YQ2	Q7
PQ2Q	P)-Q 2	2	Y2T				)Y2
PQ2	P)- P)	H7	YTV	)	TYP	QY 2	)YT
PQQT					U	2YQ)	PY
PQ2P	&	22				VYP	QYT
PQ2)	)T))T	)2	PY)	P	TYT	YTT	)YP
PQ2	)T)-)TT	T	H] +				QY
PQ2	)TP-2	P)T	2Y	P	TYT	TYQ	Y2
PQ22	)T)-2P	2	QY P	P	TYT2	PY 2	Y
PQ22	&	P	U	Q			2Y)
PQ2V	)2 -) T	PQQ	VY)	P	TYTQ	PYT2	Y
PQ2Q	)2T- V2	V	QYQV	P	TYT	PYT	PYQ
PQ2	) Q-V 2	P Q	YQ	P	TYT	TY	PY

PQ2T	2-QV	)T-VT	P V	P-22Q	&	PQ22	P-TT2-) Q	' 2)-	)P-)2		)-V
PQ2P	P-TT -TVQ	Q VV	-2VQ	P-V Q	Q)T	PQ2V	P-TTV-VW	2) V2	P2-T)V	)-TQP	P-2)
PQ2)	P2V	22 -2VV	:- V	P-QP	P-)2	PQ2Q	Q P T	2 P- 22	)) -)Q	Q- TT	)-2T)
PQ2	P-TP)-V	T-2QT	PQ-PQQ	P- PT	P-P	PQ2	Q-)2	2) - TT	)2-) T	P2	)- V
PQ2	i +T -QQT	2T)-2	) 2V2	-) T	)-) P	PQVT			7>G 'E5?7 5A		
' PQ2	P-TT2- V	2T -QV2	)2-	-P22	-TQ	PQVP	Q)2-P)	QTP-T V	))P- PV	2Q-) 2	) -TT

' F> ', =G' PQ2T7='PQ2T7F 'C ' -)Q-))2' I 7F 'C 7F'2-QPP-Q2 'E56= ?57 =LO' 'D =D= 7 =?' =8'2 'E56= ?57 == '7='PTT' I 7Fh

APPENDIX III.

(Papers handed in by Mr. William Gayton, M.D., 16th October 1868.)

TABLE A.

ABSTRACT OF SMALL-POX CASES.

App. No. 4.

| DATES. | VACCINATED WITH GOOD MARKS. | | |

)

&&(#L,<' ,,, [4 & * ' / 'G

'

30 A ' 57 ' 2' 5 ' 6=GD5 ' @' C 7F' 7F ' D 67 E ' = 75+ 7 ' 5G=?A ' 7F= ' ! 566 ?57 @' C 7F' A==@' 5?@' 7F= ' C 7F'
GD B 67' G5] - 5?@' 7F= ' 5 @' 7= F5E ' I ? ! 566 ?57 @' I?' C 7F' ?=' G5] ' E ' I+

A N566 ?57 @' C 7F' A==@' N566 ?57 @' C 7F' GD B 67' O5 @' 7=' F5E ' L ?' N566 ?57 @' #=7' N566 ?57 @

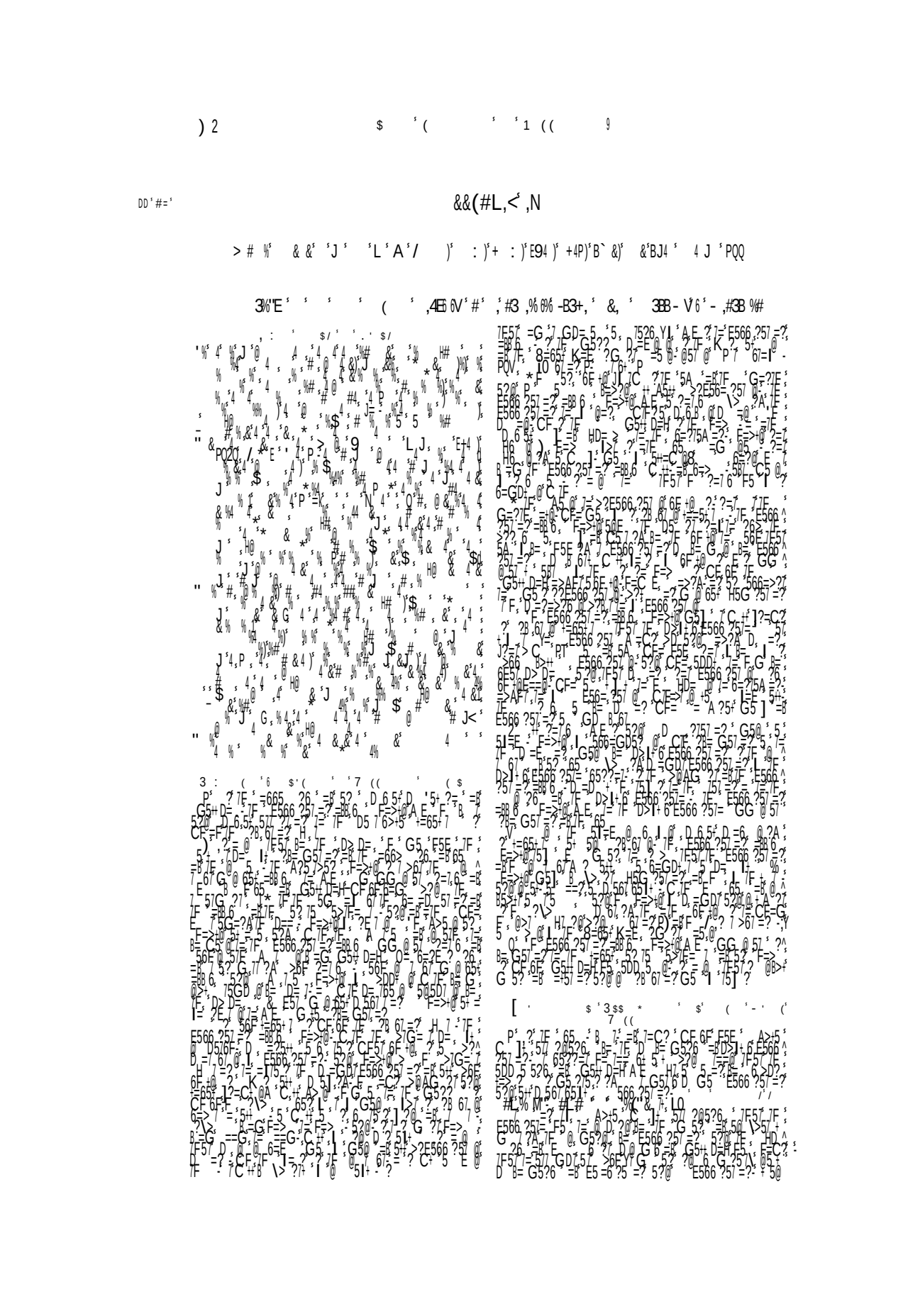
G5] G5] I>7 ?= G5] ' E ' I+

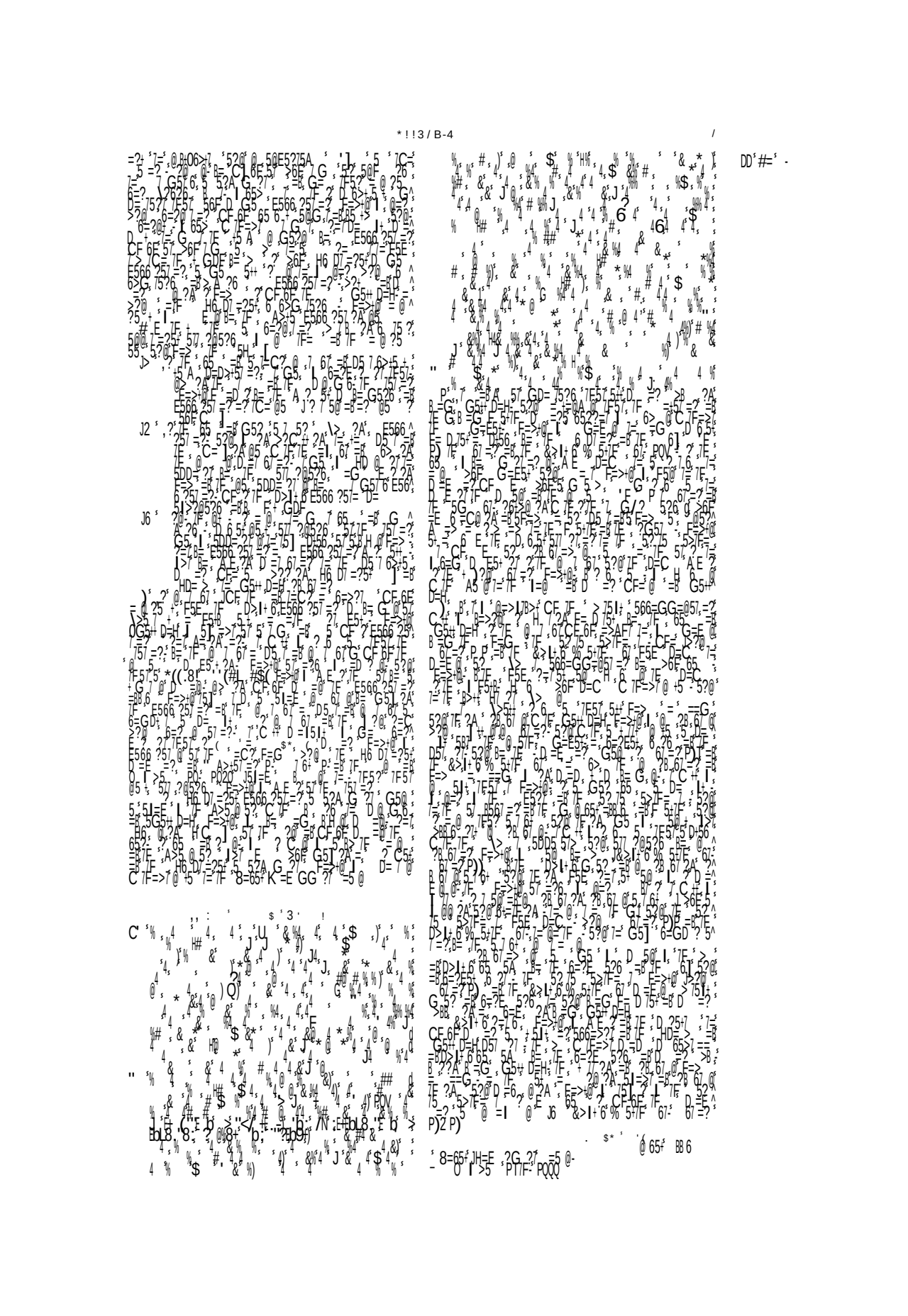
' 5 $5 L 57F 6 &?75A^ $5 - L 57F 6 &?75A^ $5 L 57F 6 &?75A^ $5 L 57F 6 &?75A^

7= ' T T))) P)V2 PQP 22
77= ' _ ' 2V T T P2T PQ P) 2 2 T TP)T) 2T
07=+)T2) P 2))V)TV T P PT PQT
' 7=' P P))P))T PV V)
H' 7=' 2T2 P)) P-T V 22 2)T P)T Q2)
' 7=' H Q PP Q PTT P P2V 22 PV Q Q
)2' 7=' 0 PQ P) 2 2) QT P2 PP2 ¶' T PT T
T' 7=' T P V P PT 2)2 VQ P2 P V 2 + 0) P
T' 7=' 2T) P PQ2 PQ Q2))Q)P
2T' 5?@' 5I= ' _ P) PP QT PQ)): 2)T 0 P
+' 5)-TQ 2) -Q2 2 P-) 2 2))V)-P2 Q

$=GI ? @' G= 75+ 7 ' VY 2' D ' 6 ?7

s s





) Q' T ' 8' $ 00, #' #' N $$ N ', #'

DD' #=' ' C ' 2' ! /' ' /' ' ! *' 6 / ' ' ' 2' "A ' 2 ' ' P' ' 22 /

MQ,#K PQQV QQ

+ '^ %A 'P TT

L G 6'

#5G ' U'

@@

66>D57 =L'U A

L57 '=B'L 57F

N566 ?57 @'J*F ? UU

J*F

J ' CF=G

J,B' >66 B>#'?>GI '=B' 65

. E566 ?57 @'J*F ?'U'

J*F U

J 'CF=G U

J,B' >66 B>#'?>GI '=B' 65 '

,B'?=7' 566 ?57 @-' =? 'B= '?=?WE566 ?57 =>

L57 '=B'D E => '57756] '=B' G5++ D=H'J B'5? 'U

$F5 567 '=B' G5++ D=H'

8 ?A7F'=B' ++? UUUUU

& E => 'F 5+7F'=B'@ 6 5 @

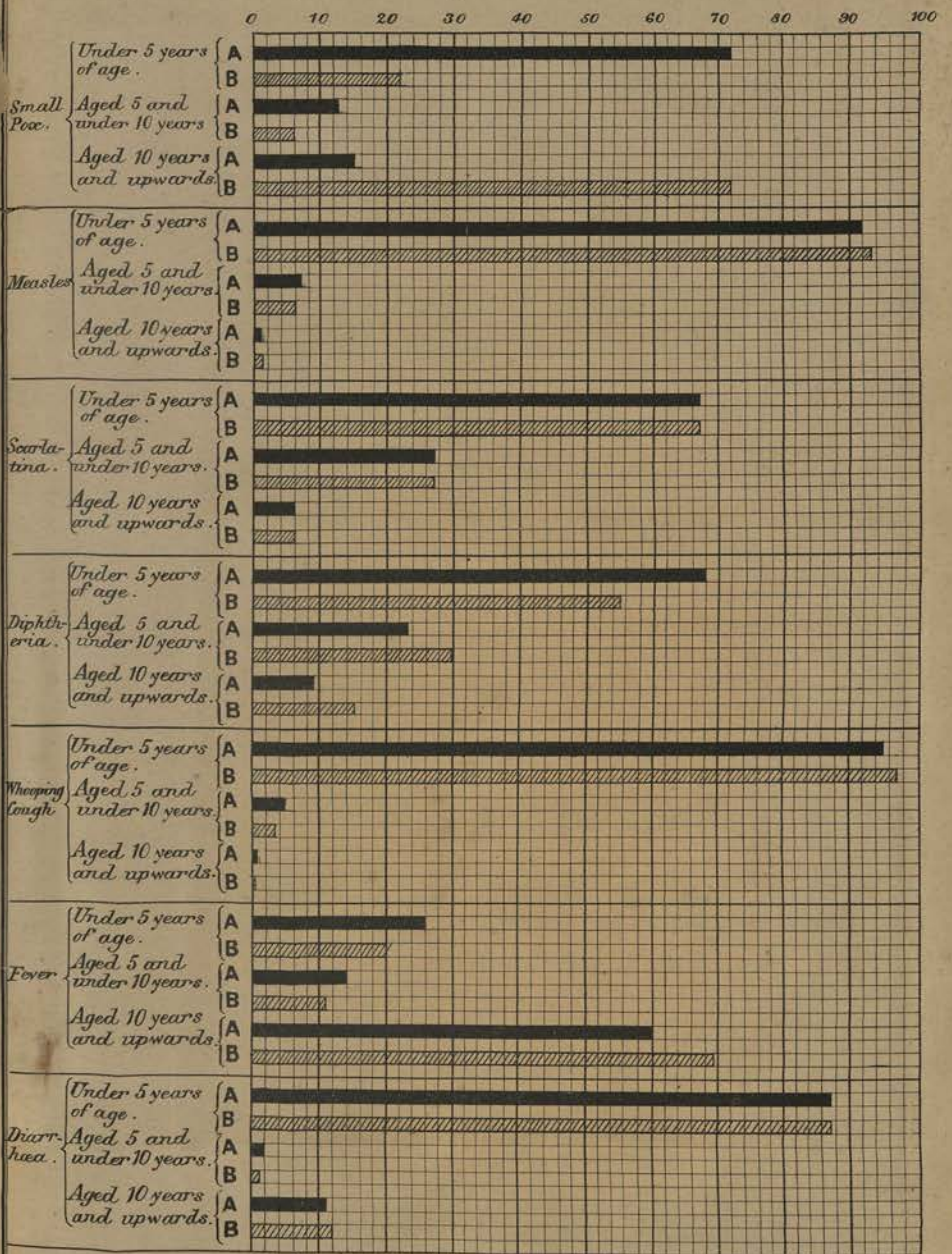
#5G '=B'D =?'E B ?A'5I=E 'B567

+57 =? F D'=B' >6F'D =?'7=' @ 6 5 @

To face page 248.

DIAGRAM A.

DIAGRAM showing the variations in the Age Incidence of the several fatal Infectious Diseases in the Borough of Sheffield as witnessed during A. the ten years 1861-70, B. the ten years 1876-83, 86-87.


0
10
20
30
40
50
60
70
80
90
100
Small Pox.
Under 5 years of age. A B
Aged 5 and under 10 years A B
Aged 10 years and upwards A B
Measles
Under 5 years of age. A B
Aged 5 and under 10 years. A B
Aged 10 years and upwards. A B
Scarlatina.
Under 5 years of age. A B
Aged 5 and under 10 years. A B
Aged 10 years and upwards. A B
Diphtheria.
Under 5 years of age. A B
Aged 5 and under 10 years. A B
Aged 10 years and upwards. A B
Whooping Cough
Under 5 years of age. A B
Aged 5 and under 10 years. A B
Aged 10 years and upwards. A B
Fever
Under 5 years of age. A B
Aged 5 and under 10 years. A B
Aged 10 years and upwards. A B
Diarrhœa.
Under 5 years of age. A B
Aged 5 and under 10 years. A B
Aged 10 years and upwards. A B

NOTE. It will be observed that the lines indicating the age incidence at one and another time have no relation to the actual amount of disease prevalent. The total of the black line gives a constant 100 for the one period and the total of the shaded line a constant 100 for the other.

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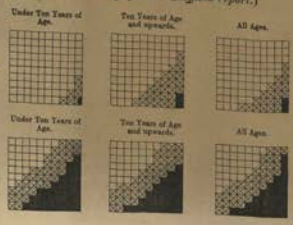
DIAGRAM C.

[INVADED HOUSES; SUB-DISTRICTS OF SHEFFIELD; IN 3 GROUPS OF AGES.]

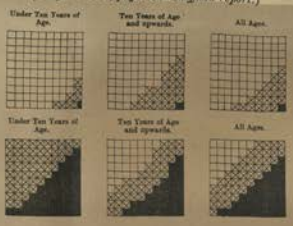
DIAGRAM *shewing the proportion in each 100 persons (of the Vaccinated" and "Unvaccinated" classes respectively) reported by the Census enumerators to have resided in the several Sub districts of Sheffield in houses invaded by Small-pox who were attacked by the disease during 1887-88 (distinguishing fatal and non fatal cases.)*

Non-fatal Small-pox. ▨
Fatal Small-pox. ■

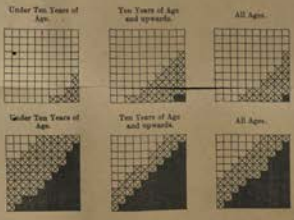
(1.) ATTERCLIFFE. (*Diagram I., page 24: Sheffield report.*)



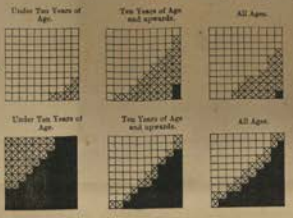
(2.) BRIGHTSIDE. (*Diagram III., page 38: Sheffield report.*)



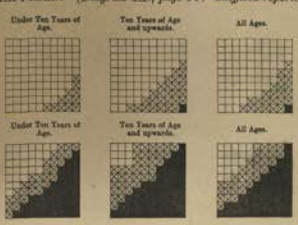
(3.) NORTH SHEFFIELD. (*Diagram V., page 59: Sheffield report.*)



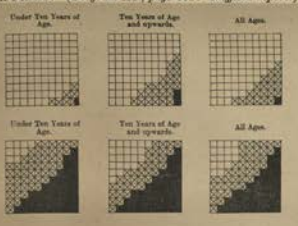
(4.) SHEFFIELD PARK. (*Diagram VII., page 80: Sheffield report.*)



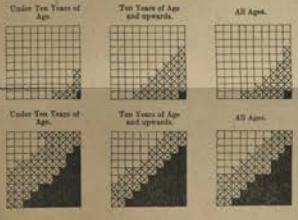
(5.) SOUTH SHEFFIELD. (*Diagram IX., page 94: Sheffield report.*)



(6.) WEST SHEFFIELD. (*Diagram XI., page 108: Sheffield report.*)



(7.) ECCLESALL. (*Diagram XIII., page 127: Sheffield report.*)



(8.) NETHER HALLAM. (*Diagram XV., page 147: Sheffield report.*)

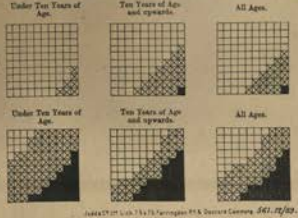


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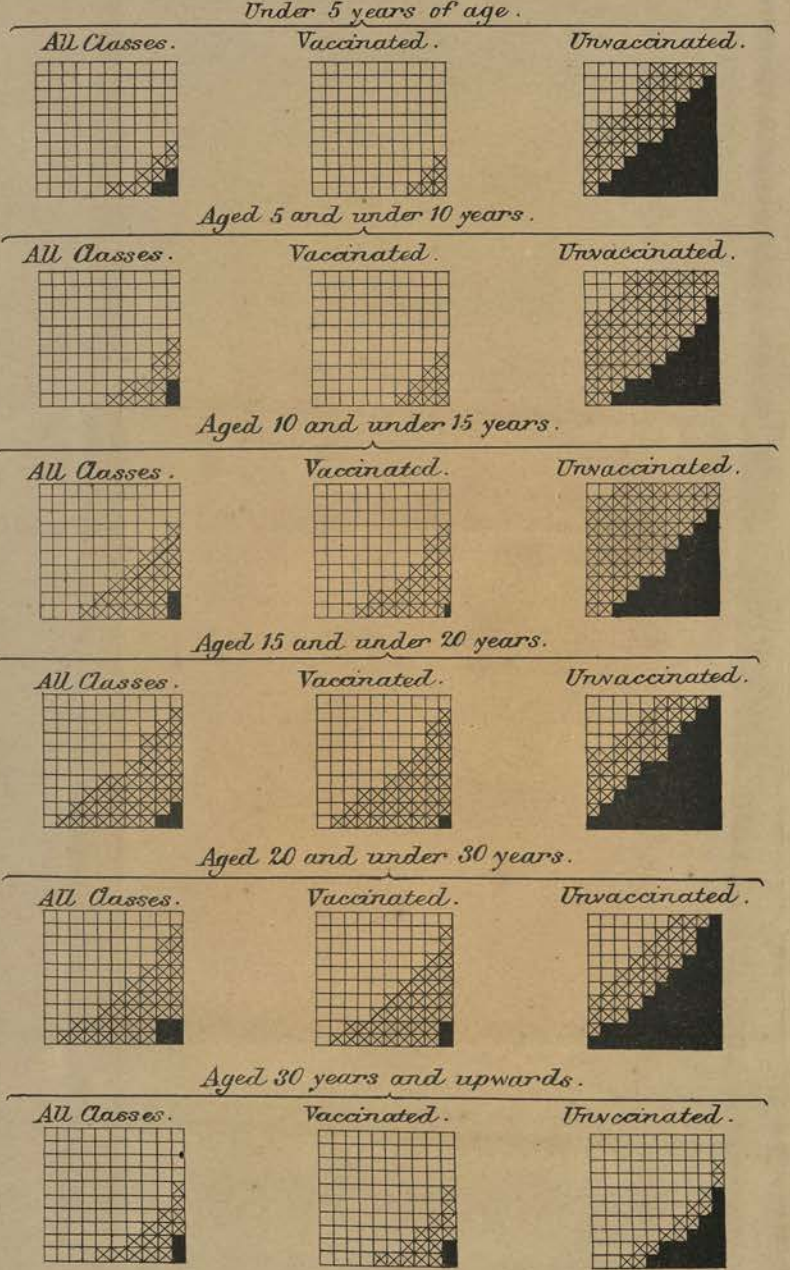
DIAGRAM D.

[INVADED HOUSES; SHEFFIELD; IN 6 GROUPS OF AGES.]

DIAGRAM showing in regard of persons residing in the houses of Sheffield reported by the Enumerators to have been invaded by Small-pox, the incidence of Small-pox Attack and of Small-pox Death, up to the date of enumeration, upon each hundred of all classes, and upon each hundred Vaccinated and Unvaccinated respectively, at each of several age-periods.



Judd & Co Ltd Lith. 75 & 75, Farringdon Rd & Doctors' Commons 561. 12/83.

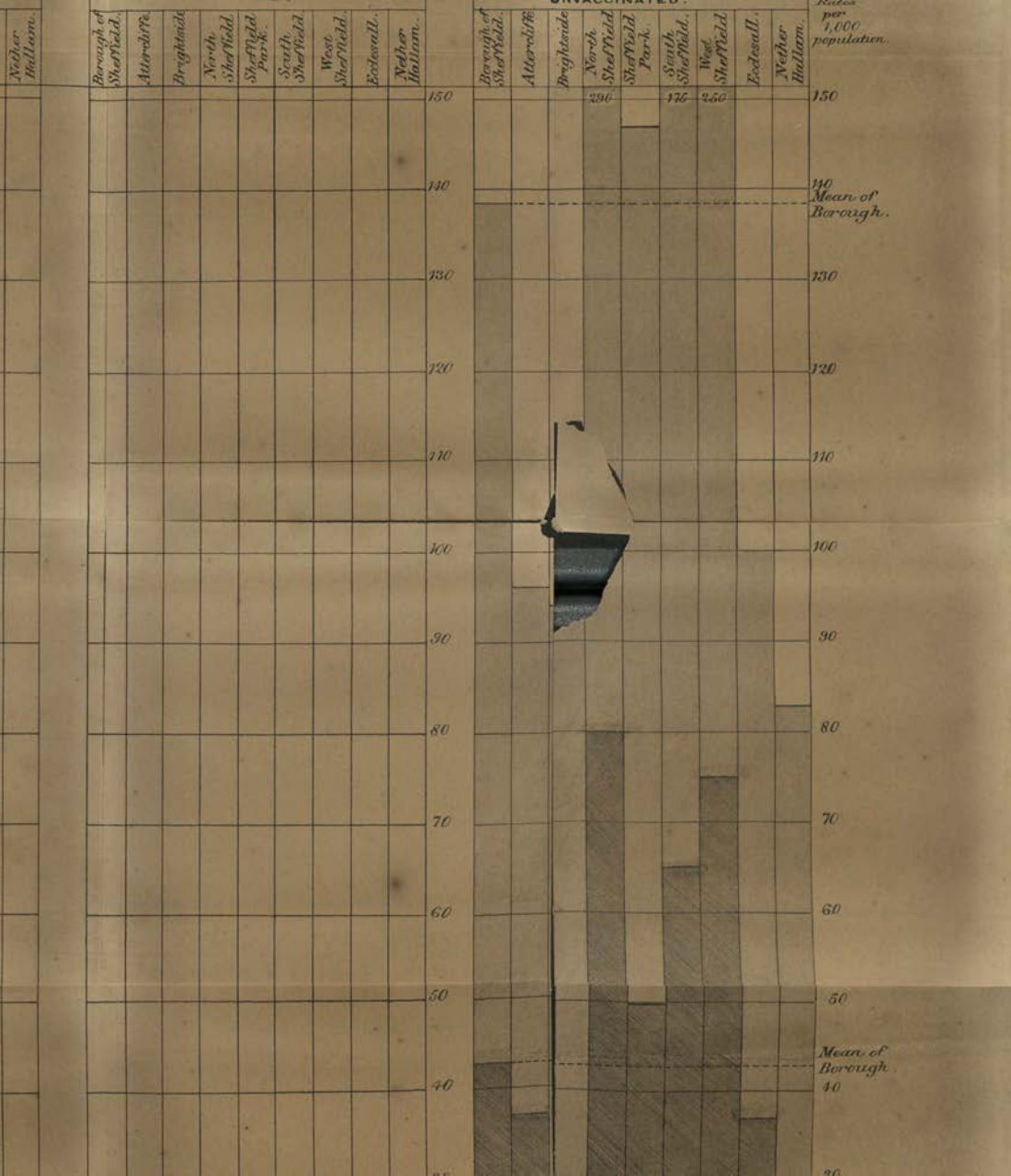
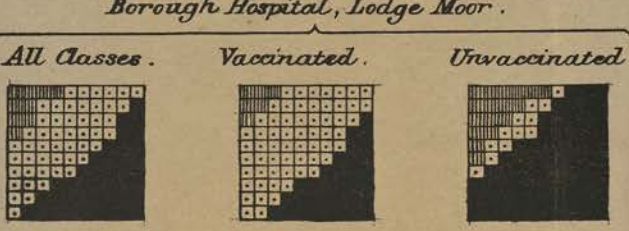

Nether Balloom.
Borough of Sheffield.
Attercliffe.
Brightside.
North Sheffield.
Sheffield Park.
South Sheffield.
West Sheffield.
Ecclesall.
Nether Balloom.
150
140
130
120
110
100
90
80
70
60
50
40
UNVACCINATED.
Rates per 1,000 population.
Borough of Sheffield.
Attercliffe.
Brightside.
North Sheffield.
Sheffield Park.
South Sheffield.
West Sheffield.
Ecclesall.
Nether Balloom.
290
176
250
Mean of Borough.
Mean of Borough.

DIAGRAM J.

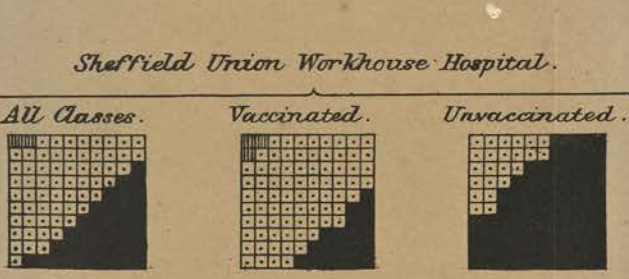
DIAGRAM *showing the proportion of cases of Small-pox of the Confluent and Discrete types respectively which occurred in persons at all ages of different classes in the Sheffield Small-pox Hospitals.*

Borough Hospital, Winter Street.

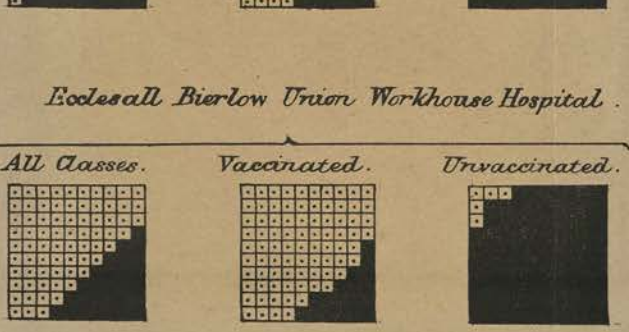
Borough Hospital, Lodge Moor.



Sheffield Union Workhouse Hospital.



Eccles all Bierlow Union Workhouse Hospital.



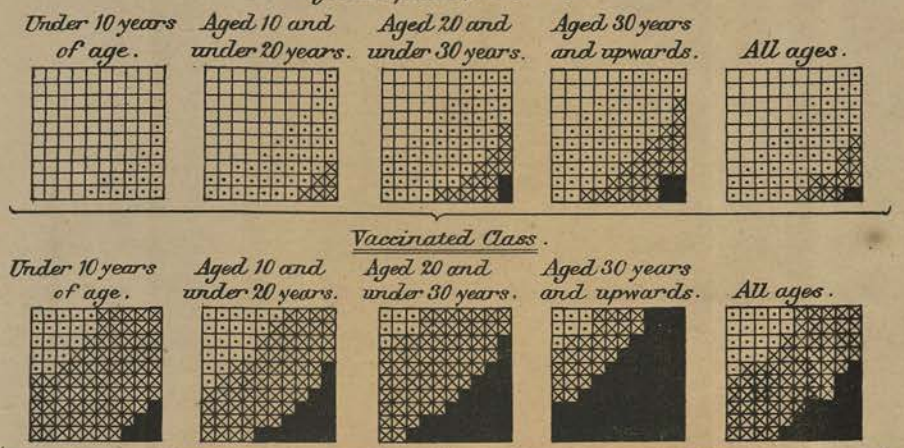
■ *Coherent or Confluent type.*
□ *Discrete type.*
▥ *Type not recorded.*

Judd & Co Lte Lith. 73 & 75, Farringdon Rd & Doctors Commons. 561.12/69.

DIAGRAM K.

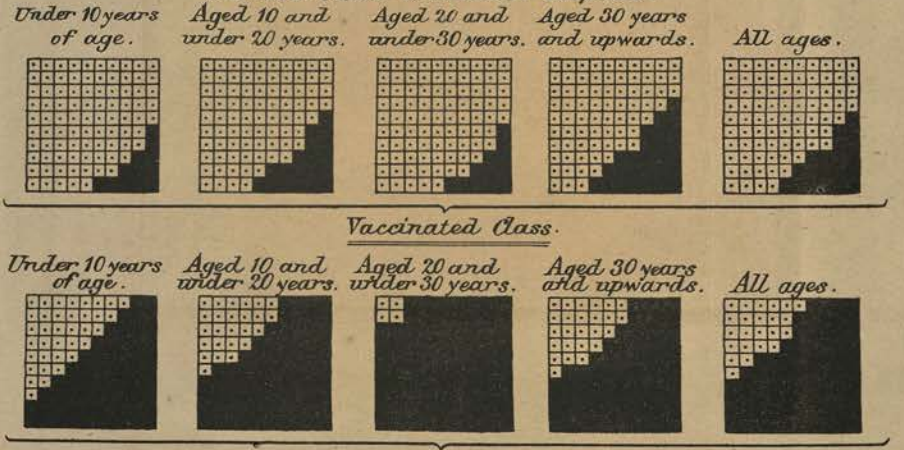
DIAGRAM *showing the proportion of cases of Small-pox of different types which occurred in persons of the "Vaccinated" and "Unvaccinated" classes respectively at all and certain specified ages in the Winter Street and Sheffield Union Workhouse Hospitals.*

Borough Hospital, Winter Street.


Under 10 years of age.
Aged 10 and under 20 years.
Aged 20 and under 30 years.
Aged 30 years and upwards.
All ages.
Vaccinated Class.
Under 10 years of age.
Aged 10 and under 20 years.
Aged 20 and under 30 years.
Aged 30 years and upwards.
All ages.
Unvaccinated Class.

■ *Confluent.* ⊠ *Coherent.* ⊡ *Discrete.* □ *Varioloid.*

Sheffield Union Workhouse Hospital.


Under 10 years of age.
Aged 10 and under 20 years.
Aged 20 and under 30 years.
Aged 30 years and upwards.
All ages.
Vaccinated Class.
Under 10 years of age.
Aged 10 and under 20 years.
Aged 20 and under 30 years.
Aged 30 years and upwards.
All ages.
Unvaccinated Class.

■ *Confluent (including Coherent.)*
⊡ *Discrete (including varioloid.)*

NOTE. *Cases with regard to which the Hospital records were incomplete have not been included in this diagram.*

Judd & Co Lith. 73 & 75, Farringdon Rd & Doctors Commons 561.12/69

DIAGRAM L.

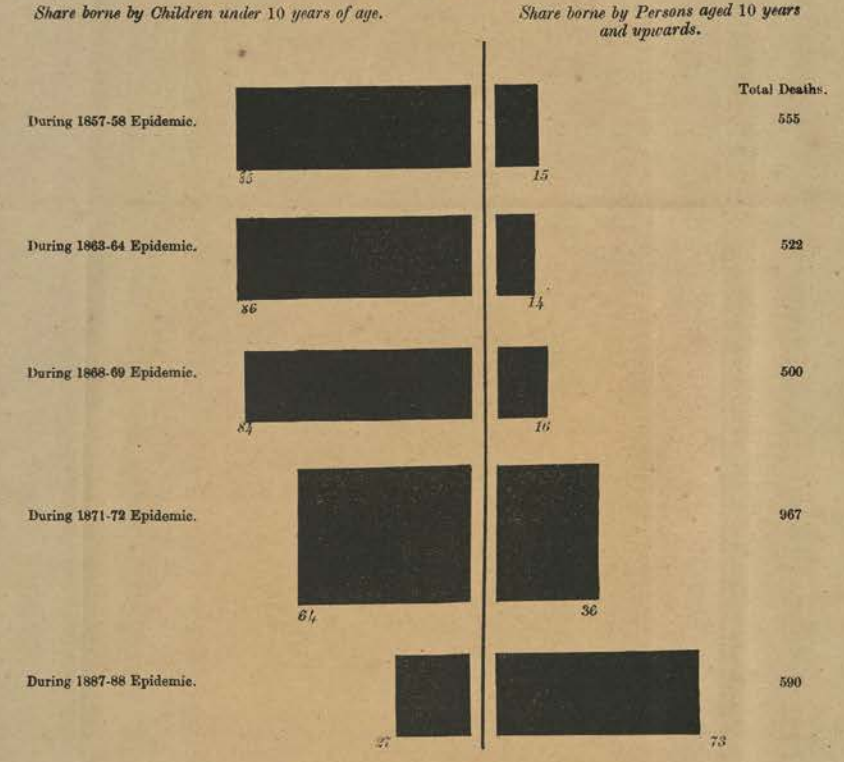
DIAGRAM *showing for the Borough of Sheffield.*

(*a*) *The share, during successive Epidemics, of the total Small-pox mortality borne by children under 10 and by persons aged 10 years and upwards.*

(*b*) *Similar facts, during 1887-88, for "Vaccinated" and "Unvaccinated" classes respectively.*

(Difference of width of horizontal bars denotes differing amounts of fatal Small-pox.)

(*a.*) Out of every 100 small-pox deaths among people of all classes in each of the five epidemics 1857-8, 1863-4, 1868-9, 1871-2, and 1887-8:—



(*b.*) Out of every 100 small-pox deaths among people of all ages in the "vaccinated" and "unvaccinated" classes respectively during 1887-88:—

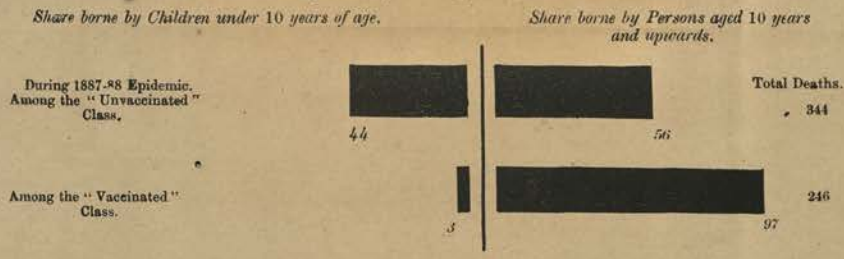


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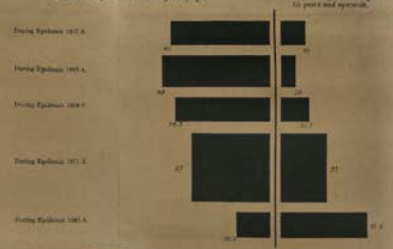
DIAGRAM *showing for each Sub-district of Sheffield during successive epidemics the share of Small-pox mortality borne by children under ten years and by persons aged ten years and upwards (Difference of width of the horizontal bars denotes for one or another sub-district differing amounts of fatal Small-pox. The relative width of the bars in this diagram is four times the scale used in Diagram L, which relates to the whole Borough of Sheffield.)*

(1.) ATTERCLIFFE. (*Diagram II. (a), page 53: Sheffield report.*)

Out of every 100 small-pox deaths at all ages and among all classes in the epidemics of 1857-8, 1863-4, 1868-9, 1871-2, and 1887-8:—

(2.) BRIGHTSIDE. (*Diagram IV. (a), page 54: Sheffield report.*)

Out of every 100 small-pox deaths at all ages and among all classes in the epidemics of 1857-8, 1863, 1868-9, 1871-2, and 1887-8:—



(3.) NORTH SHEFFIELD. (*Diagram VI. (a), page 78: Sheffield report.*)

(4.) SHEFFIELD PAR. (*Diagram VIII. (a), page 89: Sheffield report.*)

(5.) SOUTH SHEFFIELD. (*Diagram X. (a), page 103: Sheffield report.*)

(6.) WEST SHEFFIELD. (*Diagram XII. (a), page 118: Sheffield report.*)

(7.) ECCLESALL. (*Diagram XIV. (a), page 142: Sheffield report.*)

(8.) NETHER HALLAM. (*Diagram XVI. (a), page 159: Sheffield report.*)

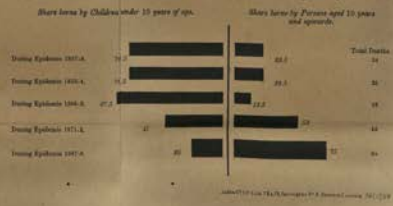


DIAGRAM N.

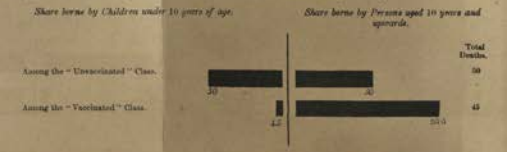
DIAGRAM *shewing for each sub-district of Sheffield during the epidemic of 1887-88 and for "Vaccinated" and "Unvaccinated" classes respectively the share of Small-pox mortality borne by children under ten and by persons aged ten years and upwards. (Difference of width of the horizontal bars denotes for one or another sub-district differing amounts of fatal small-pox. The relative width of the bars in this diagram is four times the scale used in Diagram L which relates to the whole Borough of Sheffield.)*

(1.) ATTERCLIFFE. (*Diagram II. (b), page 33: Sheffield report.*)

Out of every 100 small-pox deaths in the epidemic 1887-8, among people of all ages in vaccinated and unvaccinated classes respectively:—

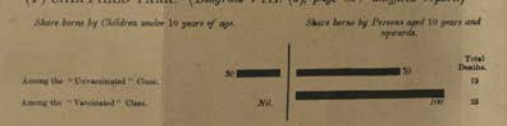
(2.) BRIGHTSIDE. (*Diagram IV. (b), page 54: Sheffield report.*)

Out of every 100 small-pox deaths in the epidemic of 1887-8 among people of all ages in the "vaccinated" and "unvaccinated" classes respectively:—

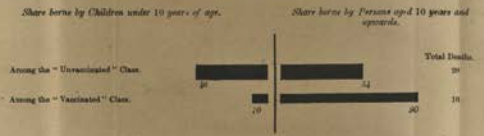


(3.) NORTH SHEFFIELD. (*Diagram VI. (b), page 75: Sheffield report.*)

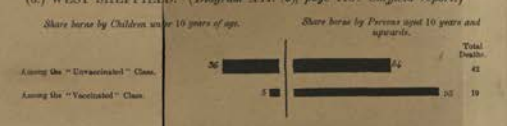
(4.) SHEFFIELD PARK. (*Diagram VIII. (b), page 89: Sheffield report.*)



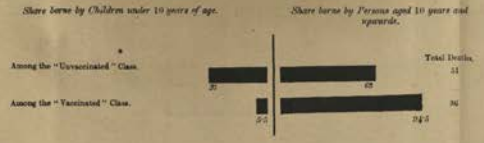
(5.) SOUTH SHEFFIELD. (*Diagram X. (b), page 103: Sheffield report.*)



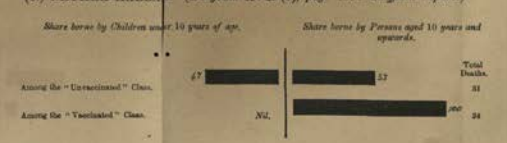
(6.) WEST SHEFFIELD. (*Diagram XII. (b), page 118. Sheffield report.*)



(7.) ECCLESALL. (*Diagram XIV. (b), page 142: Sheffield report.*)



(8.) NETHER HALLAM. (*Diagram XVI. (b), page 159: Sheffield report.*)



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F $ ' /'

P ' 0 < # W' = 0 g P P

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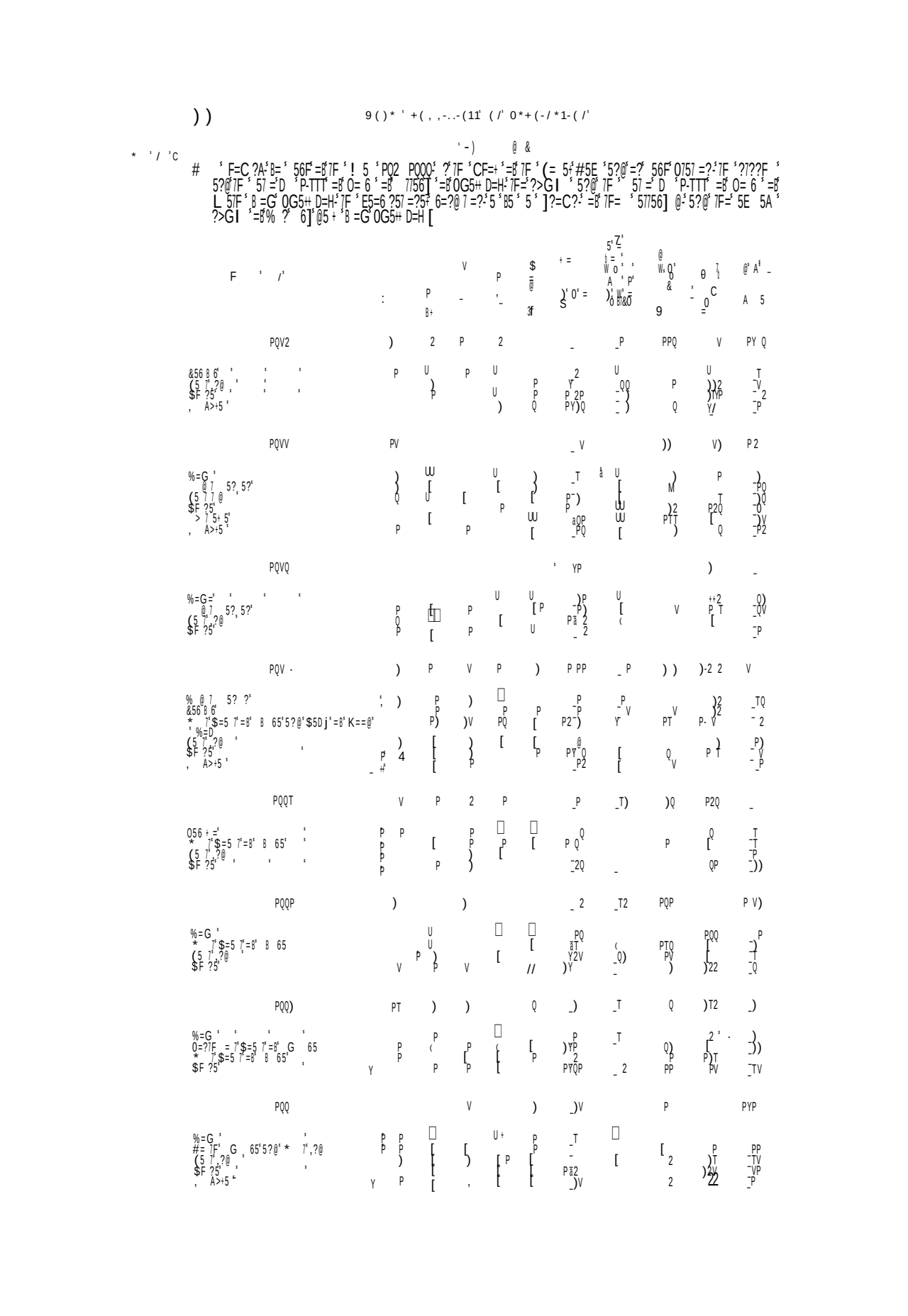

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PQ2T QQ-'C 7F-' ?' 56F'65 -'7F ' 57 = 'D 'P-TTT'=B'O= 6

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* Y ' ' B '
'F 'F

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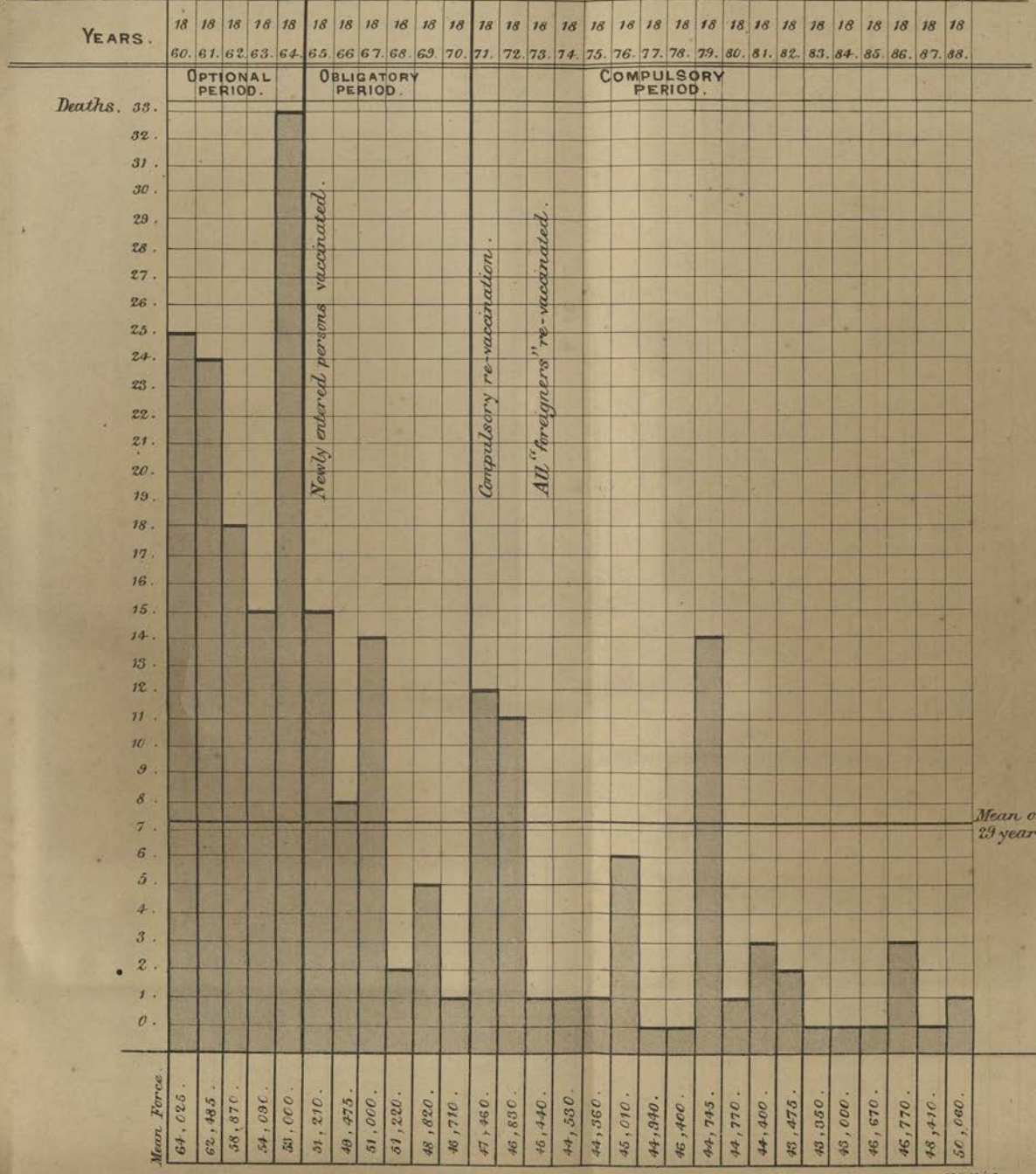
DIAGRAM SHOWING THE ANNUAL MORTALITY FROM SMALL-POX IN THE ROYAL NAVY DURING EACH OF THE YEARS 1860 TO 1888.

To face page 254.

App. N° 5.



Judd & Co. Lith. 73 & 75 Farringdon Rd. & Doctors Commons 503.12/83.

&&(#L,< N,

> # % & & B= 56F= 7F 5 PQQ2 7= PQQQ 7F 7 G57 &=D>57 =?7F 2>GI =B L 57F 8 E ?A- B=G ,"(8 #L

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F=C ?A- B= , +5 @ B= 56F= 7F 5 PQ2 7= PQQQ 7F 7 G57 &=D>57 =?7F 2>GI =B L 57F B=G @@> ?A 56F=B7F 5I=E ! 5 - 5?@7F 57 D ++=?+ E?A- B=G

7H			C H C 6	7C	C		
7HC	&	&	C C8 C78	H	7 Q		
7HH		&	C C 8	8	GC&		G
7H6		&	C 7H C 8		GQ7		C
7H7	&	&	C HC 8	G	Q		
7H8	&	&	C 8 8		G&6		H
76	&	&	C 7 C	G	C&8		
76	&	&	C G87 68	HHC	GQ		C
76	&	&	C G6 78	G 7	H QC		C
76G	&	&	C G 6 8G7	C	8QH		7
76	&	&	C 87 868	CH8	6QG		7
76C	&	&	C 67 H 8	CGG	Q		
76H	&	&	C 66 C		QC		C
766	&	&	C 7H G7	6	GQ		H
767	&	&	C 7 H	76G	HCQG		8
768	&	&	C HC H C	H6	6QH		
77	&	&	C H7	G78	6Q7		7
77	&	&	C 87G	7	P W		8
77	&	&	C 86 7CG	G6	HQ8		7
77G	&	&	C C 7	8	YQ		G
77		&	8H H8G		TYQ		G
77C	&	&	8 G		Q		H
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777	&	U	666 CG	Q	Q6		

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F=C 2A- L 6 22 5 &= @ 7F = 5 # GI 5 =B L 7F B= G 3 = V >5 +5?@- 7F & =D= 7 =?+ E ?A- B=G >6 L 5 7F 7= L 5 7F B= G ++ $5> - 52@7F E 5A ??>5 #>GI =B L 57F D ++=?+ E ?A- B=G PQ P != PQQ Y C 7F +] @ 5 + B= 7F AF7 ! 5 PQQP QQ Y 7

| | | | | | | |

DIAGRAM ILLUSTRATING TABLE [illegible]

DIAGRAM *Showing the Small-pox Death rate per million living during the periods 1831-41, 1841-51, 1851-61; April 1861 to December 1870, 1871-80, 1881-88, the proportion of Deaths from Small-pox to Deaths from all causes during these periods; and the Vaccination Laws in force in each period, in Ireland.*

To face page 256

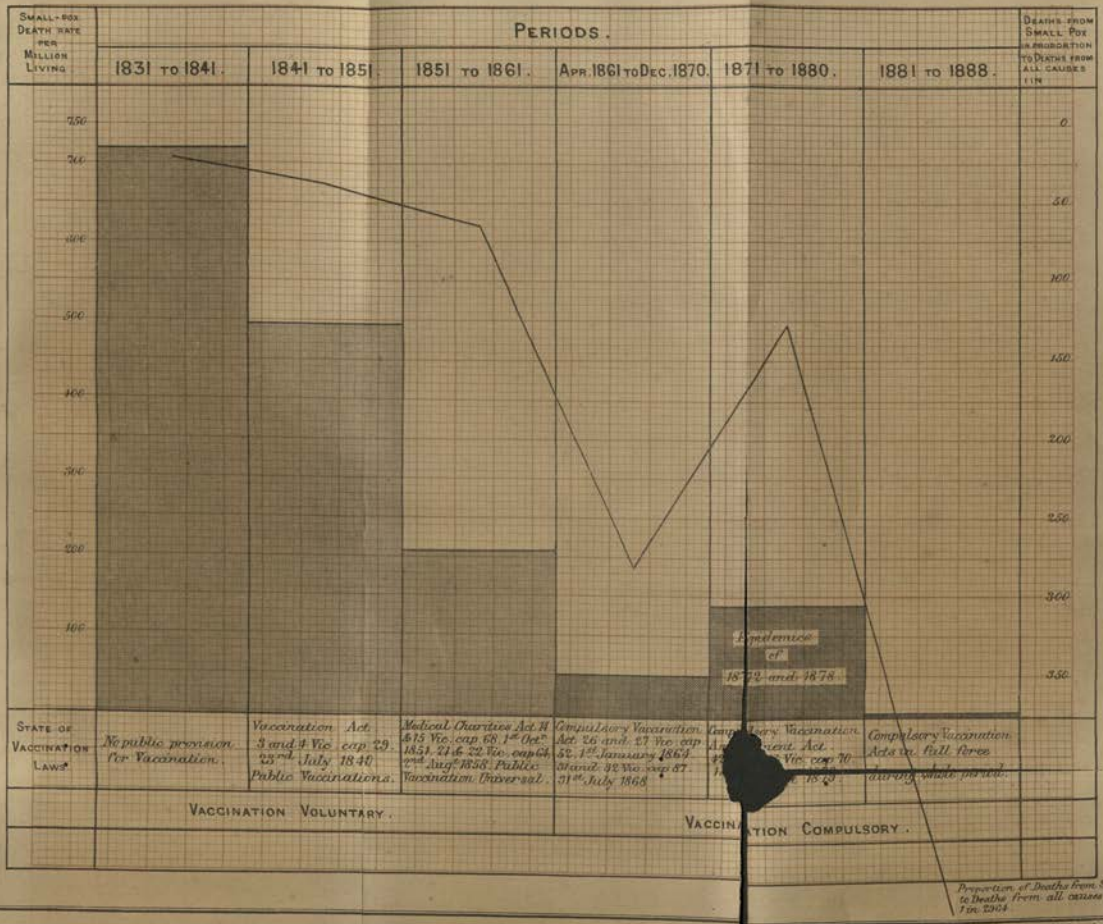
Small-pox Death rate per Million Living
Periods.
1831 to 1841.
1841 to 1851.
1851 to 1861.
Apr. 1861 to Dec. 1870.
1871 to 1880.
1881 to 1888.
Deaths from Small-pox in proportion to Deaths from all causes 1 in
600
500
400
300
200
100
0
30
100
150
200
250
300
350
Epidemics of 1872 and 1878.
State of Vaccination Laws.
No public provision for Vaccination.
Vaccination Act. 3 and 4 Vic. cap. 29. 25th July 1840. Public Vaccinations.
Medical Charities Act. 14 & 15 Vic. cap. 68. 1st Oct. 1851. 24 & 25 Vic. cap. 64. 2nd Aug. 1858. Public Vaccinatum Universal.
Compulsory Vaccination Act. 26 and 27 Vic. cap. 82. 1st January 1864. 31 and 32 Vic. cap. 87. 31st July 1868.
Compulsory Vaccination Act. [illegible] Vic. cap. 70 [illegible]
Compulsory Vaccination Acts in full force throughout whole period.
Vaccination Voluntary.
Vaccination Compulsory.
Proportion of Deaths from Small Pox to Deaths from all causes 1 in 2304

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DIAGRAM ILLUSTRATING TABLE C.

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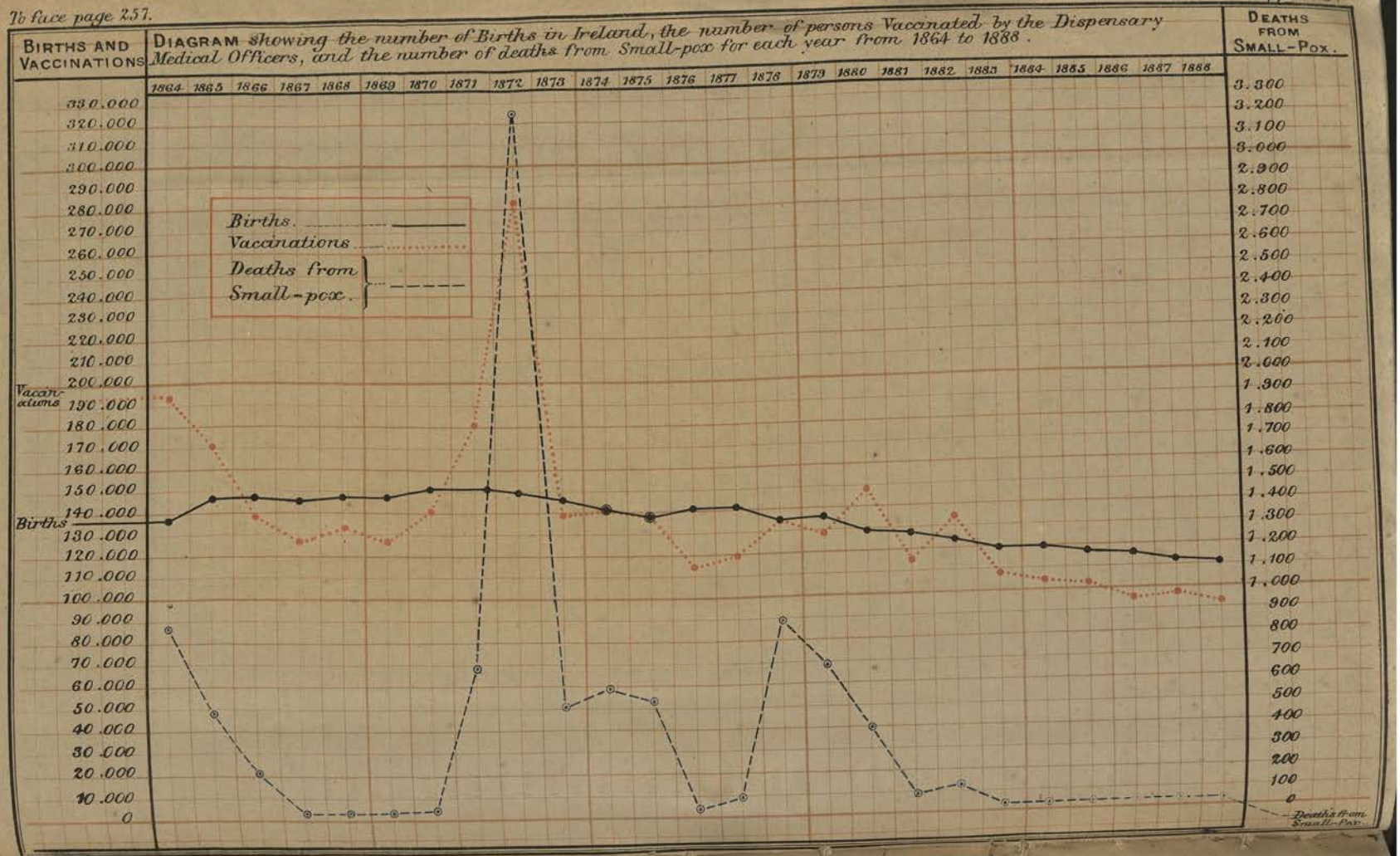
DIAGRAM showing the number of Births in Ireland, the number of persons Vaccinated by the Dispensary Medical Officers, and the number of deaths from Small-pox for each year from 1864 to 1888.



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' F=C ?A' B=' 56F' 5 ' B =G' PQ2 ' 7=' PQQQ-' I=7F' 5 5' ?6+> E -' 7F ' #>GI ' =B' 7F ' ?' +5?@-' 7F ' #>GI ' =B' & =? ' E566 ?57 @' I ' 7F ' L D ? 5 ' @ 65' BB 6 -' 7F ' #>GI ' E566 ?57 @' CF=' C ' I= ?' Ê ?6 ' 7F ' P 7 :5?>5 ' PQ2 -' 7F ' #>GI ' E566 ?57 @' CF=' C ' I= ?' I B= ' 7F ')?@' :5?>5 ' PQ2 -' 5?@' 7F ' #>GI ' =B' L 5?F ' B =G' P

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7HH' &'	&' &	□H E	G6E □	□ 6G	G G8□	8□
7H6' &		□□ G77	CR 6□	6 □6G	7 H7	'
7H7' &'	&' ' &	□H C	G □ H	7 H G	7 G	N G
7H8' &		□C HC8	H H6	6 8	6 6H	)T
76 ' &		□8 7□H	A	GC C6	C HG	7
76 ' &		C G C	68E778	G8 CG	□ 7GH	HHC
76 ' &		□8 67	7 □7□	□ HH	78 7	G □7
76G' &		□□ G66	G7 76G	8 G 8	8 CC□	C □
76□' &'	&' & &	□ 77	G8 H76	8 GG6	C	CH8
76C' &		G7 G	G6 G□	8 H6C	6 HHC	CGC
76H' &		□ □H8	□ □76	□78	887	□
766' &		G8 HC8	6 H68	C 8	□78	6
767' &		G□ 6	GG □C	□8	'78H '	76G
768' &		GC G 7	C 8	7 □ 6	' 7 □7□	H6
77 ' &		7 7H	□6E7 7	G7 □ G	8 □ C	GW8
77 ' &		C 7□6	G CC6	8 88C	G CH	P 6
77 ' &		H□7	G " 7 C	□ □	7 □ □	8
77G' &		7 HG	H 6	□	□ 7	H
□ □'		7 76C	¡C□7	88 □□C	7 G	P
77C' &		C 8C	G	88 G	G 8	□
77H' &		G 8 6	8□ 7H	8 868	77	)
776' &		□	8H □78	8 8G8	G CC	□
777'		8 CC6	8 □87	78 H 6	76	G

1 ' 7H□' '-' 777' &' & G GCG HG 7 G7 □ 8 6 7 87 '□H G'- 8 G8.

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DD' #=' 2 # ' ,

' F=C ?A' 7F ' #>GI ' =B' 7F ' A 7 @-' 7F ' #>GI ' =B' N566 ?57 =? ' D B= G @' I ' 7F ' L D ? 5 ' @ 65+' BB 6 -' 5?@' 57' 7F ' $=C D=H' ,? 7 7>7 =?-' 7F ' ' =75+' #>GI ' =B' &>I+ 6' N566 ?57 =? ' ?' 7F=' L>I+ ?' " A 7 57 =?' L 7 67-' 7F ' #>GI ' =B' 65 ' =B' - v' 5@G 77 @' 7=' 7F=' L>I+ ?' %= D 75+ -' 5?@' 7F=' #>GI ' =B' L 57F ' B =G' P' A 7 @' ?' 7F=' L>I+ ?' " A 7 57 =?' L 7 67' B =G' 7F ' 5 ' PQ2 ' 7=' 7F=' 5 ' PQQQ-' I=7F' 5 ' ?6+> E ' -

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) : % Q 0 B ' ' 0 ; + & =' ' ' 1 - &; G □ C . & =' ' ' " M @E B ' ; ' . & ' =Q

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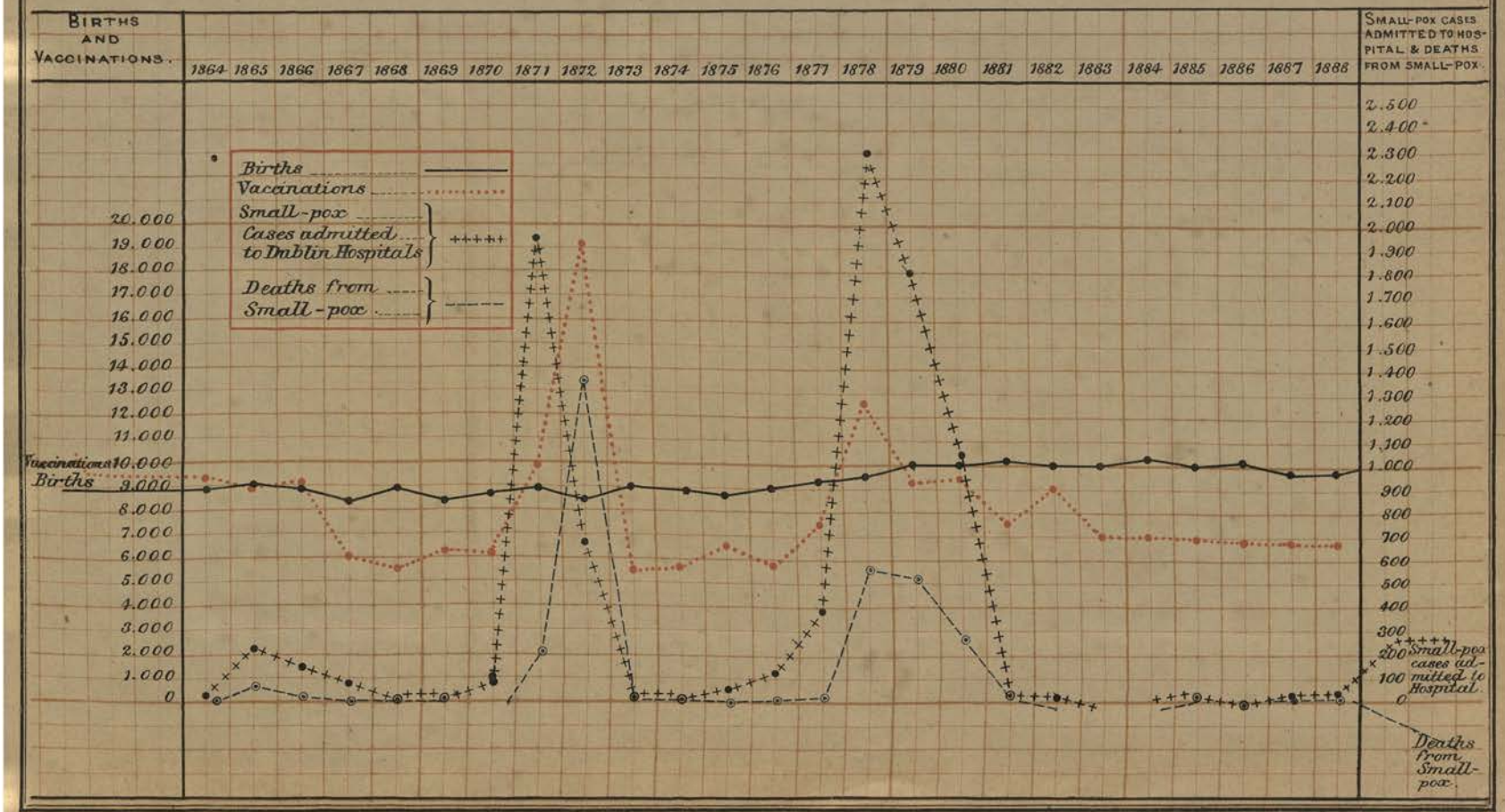
7HC' &	7 8 G	6□ 7	□6G	7 77		6
7HH'	7 H8C	□ 6C	7	7 86	G8	C
7H6' & S	7 □	□ 778'	6	H H	6	G
7H7'	7 7□H	□ GH	HH	C C		
7H8' &	7 6H	□ 6 7	□	H		
76 ' &	7 C□H	□ 77H	6G	H C8	78	
76 ' &	H 7H	6 HG	6	8 6	8G	6
76 ' &	7 □88	C 86	89:0 ;	8 H8	HC	7C
76G' &	8 G	□ 8' U	H	C GH8		H
76□' &' U' &	7 8 G	□ 6	GCG	C H6G	0	
76C' &	7 H7	C G7	□	H □C8	□	
76H' U	8 H	□ HH	□ H	C H7	&5	
766' &	8 G C	C CHG	7 □	776	776	G7
767' &	8 C G	C7H	H□	HC	G	CC
768' &	8 88G	C 8	G 7C	8 □6	686	C
77 ' &	H	6 □	6□	8 87	□	HH
77 ' &	CC	C G	G7	6 GH8	6	
7. ' &	6G	C 66	G 67G	7 7H		&
77G	8 8CC	C C7	8 H	H 87□	#	&
77□' &	H7	□ 7□8	8	H 8H7	&	&
77C'	□□	□ 8H	7C	H 7 G	G	
77H' &	88	□ 8	7	H 6 □	&	&
776' &	8 7□	□ 7 7	76G	H H8		
777' U	8 77□	□ 68	7 H	H H H	7	

Q') ' ' ' B '
') ' ' ' .
' / ' ' ' ' ' ' ' ' ' ' ' G ' ; ' , ' ' ; ' ' ' 767' ' ' ; ' ' ' ' ' H ' ' 6

DIAGRAM ILLUSTRATING TABLE D.

DIAGRAM showing the number of Births registered in the Dublin Registration District; the total number of Public Vaccinations in the Dublin Registration District; the number of Small-pox cases admitted to the Dublin Hospitals; and the number of Deaths from Small-pox registered in the Dublin Registration District from 1864 to 1888.



Judd & Co. Lith. 73 & 75, Farringdon Rd. & Doctors Commons 487.11/89.

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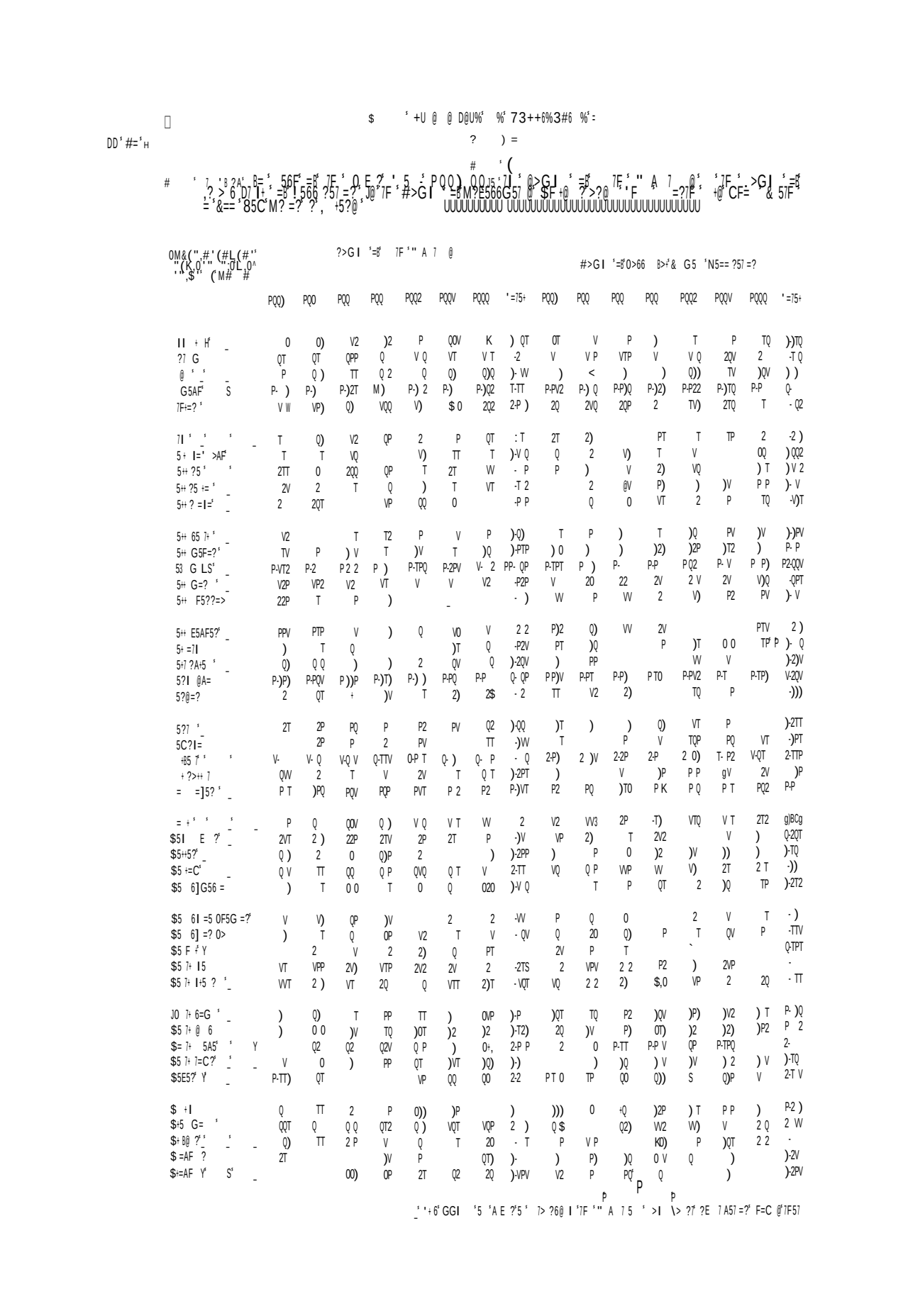
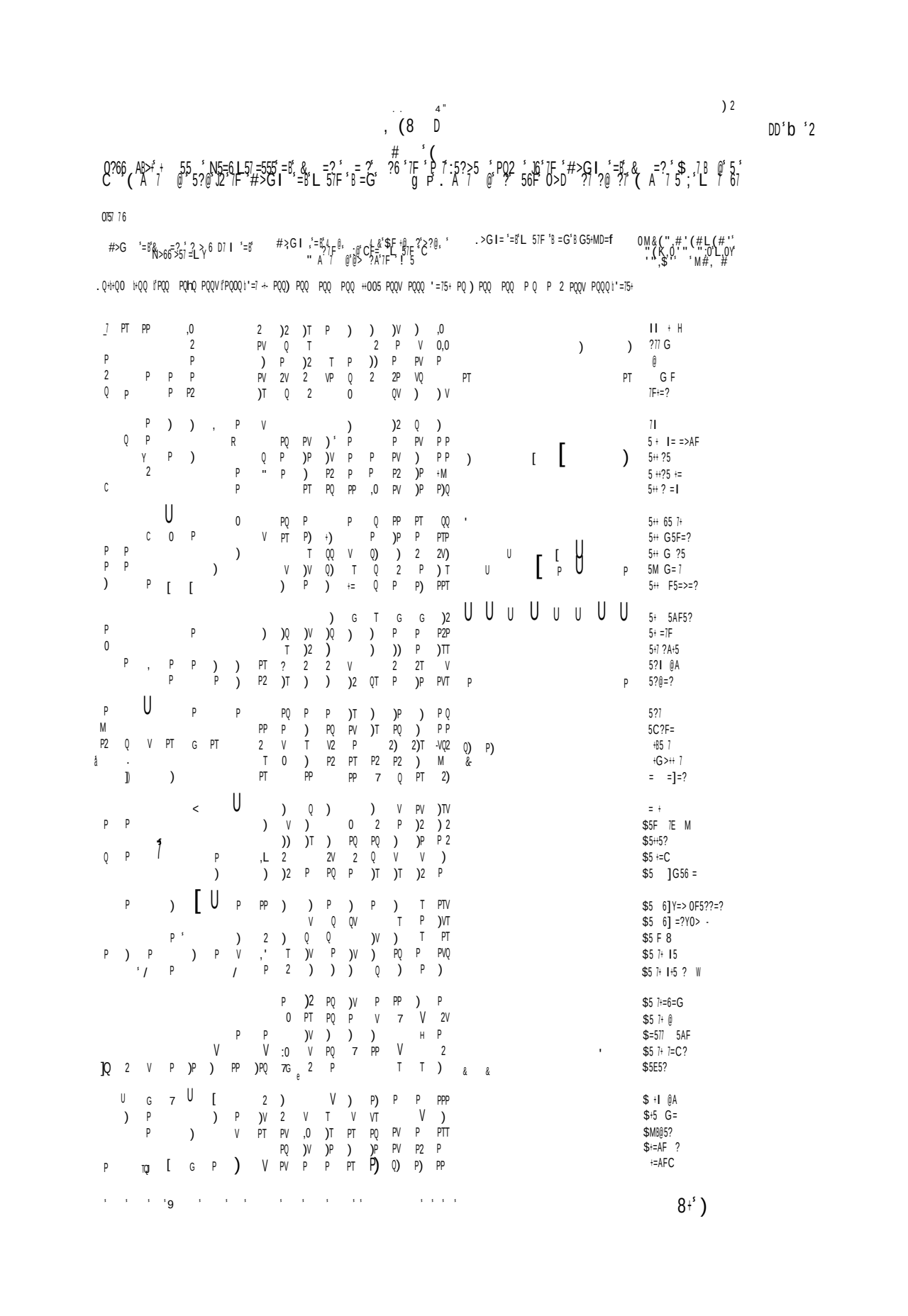
‘ F=C ?A:‘B= ‘ 56F‘=B‘ 7F ‘0 E ?‘ ! 5 -‘ PQQ) QQ‘ [J5‘7F ‘#>GI ‘=B‘ 7F ‘ " A 7 @‘ ‘ J2‘7F ‘#>GI ‘=B‘
0>66 B>‘ & G5 ‘ N566 ?57 =? ‘ =B‘ & =? ‘ = ?‘ ?6 ‘ 7F ‘ P 7‘ :5?>5 ‘ PQ2 ‘ J6‘ 7F ‘ #>GI ‘=B‘ & =? ‘
$ 7 B @‘ 5 ‘ ,? > 6 D7 I+ ‘ =B‘ N566 ?57 =? ‘ J@‘ 7F ‘ #>GI ‘=B‘ M?E56= ?57 @‘ $F +@ ?‘ >?@ ‘ ' F ‘ =?7F ‘
+@‘ CF= ‘ L 57F ‘ C ‘ " A 7 @ ‘ 5?@‘ J ‘ 7F ‘ #>GI ‘ =B‘ L 57F ‘ B =G‘ P‘ " A 7 @‘ ?‘ 56F‘
0>D ?7 ?@ ?7‘ " A 7 5 ;‘ L 7 67‘ = ‘&== ‘85C‘ M? =?‘ ?‘, +5?@





)2) " ! 8 $,00, # # N $$,# ', #

N566 ?57 =?

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L=C?D5? 6]'	P T	P-TV	P-T Q	P-T)	P-T	P-T T	P-TP	V- VT	P-T	P TP	P-T2		)	))	)V	$Q2P
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L>I+ ?'#= 7F	-)	-)	-)Q	- V	22V	-)	-2P	QP-Q2V	)-V)2	)-2VT	)-Q2)	)-Q2	Q-T2T	)-W	)-QPQ	P -V2
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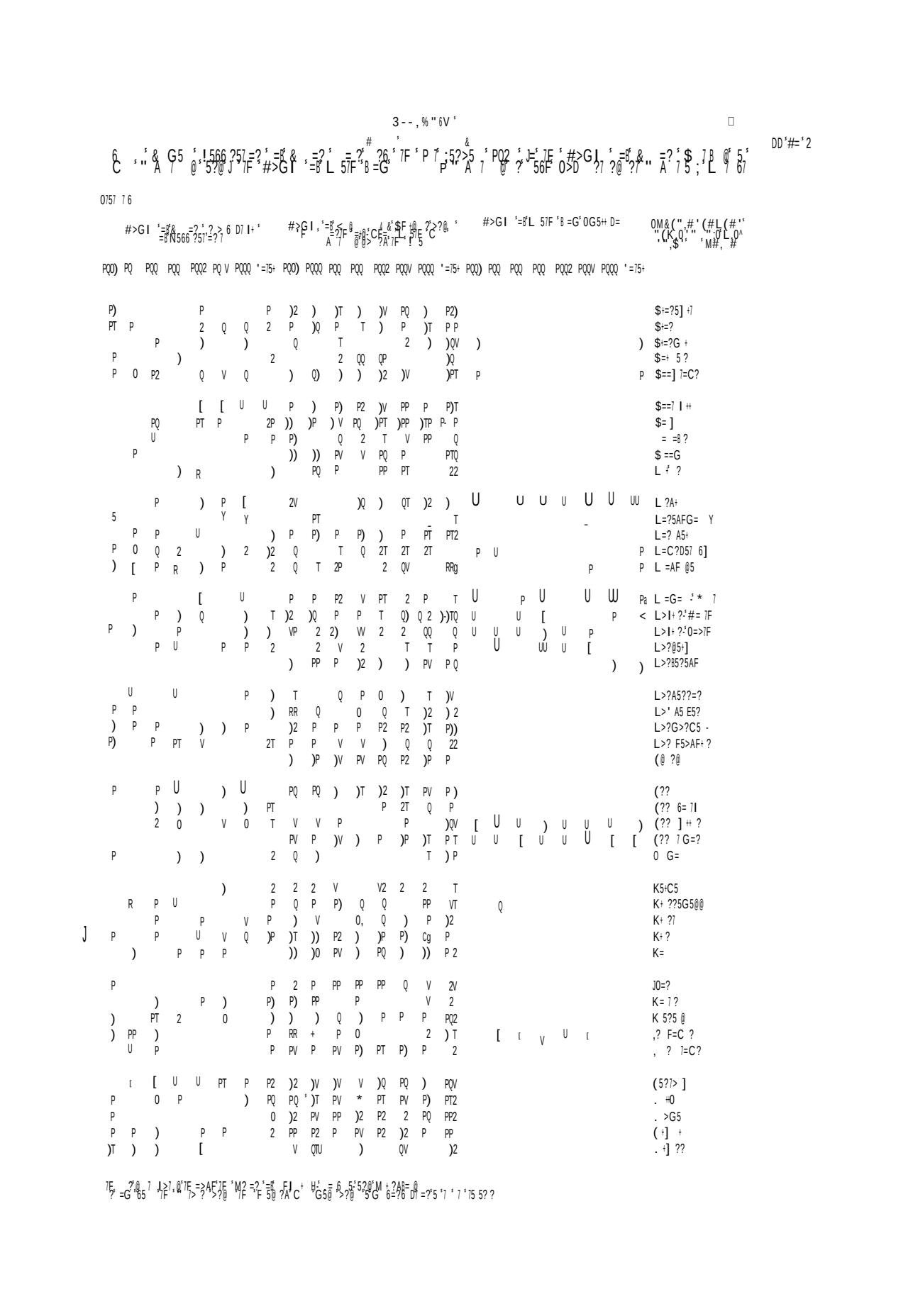

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E- 6%# %' %# #' 6 # E%6 %

#>GI =8 7F ,7 =@ #>GI '=8 0>66 >2& G5 N566 ?57 =?

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. +G5++=6]T	V Q	V)P	2TQ	2	2T0	2P2	2)	-V	VTV	2 T	2)V	2 T	2T	2T	2P	- P
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8 G 6]'	P P	P-V 2	P-Q)	P V)	P-V5	P-2	P-VTV	P)		P-2)	P- P)	P V	P- 2	Q	P-P2	P-)P	-QT2
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5+=C'	2 2	2V	QQ	QP)	2P	22		-P)T	2PP	2P	22V	P	2VP	2QT	T	V2
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=?5AF5?	22)	2P)	2VT	;M	2T)	2)	0	- V2	2	2TP	2)V	Q	2)V	Q P	P	V
=>>7I@+ C'	)	`	QQ	V2	Q T	V)		)-V P	T	T	)		0 0			)-QT
=>?7 ++ =]'	V)	VP2		VPV	22	VT	2Q		2)2	2)	2VP	2TT	2T	2 V	P)	-)Q
5L ?A5	V)	V	VT2	V	2V	2VV	2)	- QQ	2	VTT	VT	2 2	VQV	2PQ	2)P	-2P)
#55 '		Q 2	T	Q2T	Q T	Q P	V)	2 T)V	2	V)	2T	V)Q	2PQ	2)	2VT	-2V
#5E5>'	QQV	0$	QQ	2P	Q		Q V	)- V2	Q)	)VQ	)Q	QT	) P	) T	)PV	P- VV
# ?5AF	TT	2VT	22)	2Q2	2 P	C	2Q	- P	2)	TQ	2TP	2)	2	22	Q)	-22V
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# C' "=	QQT	T2	T	VVQ	VV	V2	VT2	-2P	2T2	2	V)	2)2	22	2	22V	-VTV
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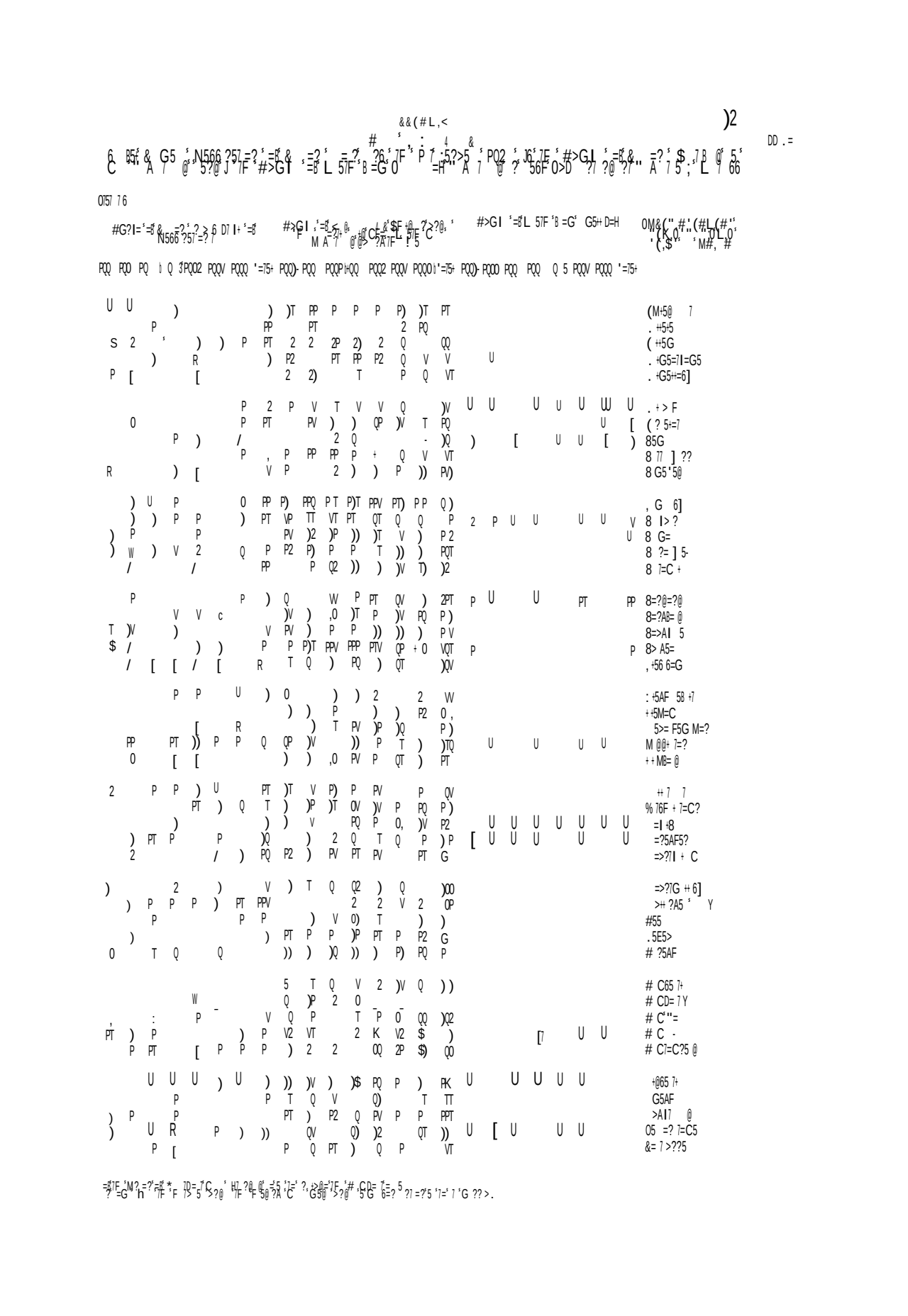
+@65 7+	W	)T	P	V	QV	2	0	)-QVT	+T	Q)	Q	Q		Q	) 2	)- QV
G5A5'	)	QP2	Q))	QTT	VV	V	V)T	2-2T)	Q T	VV)	T)	QV	VV)	V)V	2VV	2-2
>AI7 = @'	V	)		V	Q	V		Q)VT	QV)	)V2	2P	5=		QT	W	Q-)
D5 =? 7=C?'	TW	2ML	2Q2	T V	TQT	2)V	2 T	-2 2	)	VT	2W	2Q	2 2	2Q	)V	-T
O= ?>G?5	)		)	) V	))	P	PT	P-2)T	5	))Q	P)	)2	)TV	P 2	P	P- 2

' G ' ?>GI '5 M? =?' =8 # C D= 7 C5 ' @ 7F ' ' = E @ 5 ?'7F='Q7I' \> ? 7 >E' ?5 2@'7F ' I=>?@5 F=C @7 57



)22 '+ ! 8 $,00, # # N $$,# ', #

' #S ' 2V' ` J] ' # ' ,? > 6 ,D7 [+ ' =8 N566 ?57 =? J6 ' 7F #>GI ' =8 M?E566 ?57 @ $F +@ ? >?@ ' F ' ; A F 7 ; @ ']h 7F ' #>GI ; ' =8 056 ; =?7F +@ CF= L 57F =' &== 85C M? =? ? , +5?@ [

0M& '"(K,0'' (,$'' (M#, # '"(K,0'' (,$'' (M#, # #F(#'' #>GI '=8 7F ' 8 A 7 @ #>GI '=8 0>66 8>=' & G5 ' N566 ?57 =?

			PQQ	PQQ2	PQQ2	PQQV	PQQQ	'=75+	PQQ)	PQQ	PQQ	PQQ	PQQ2	PQQV	PQQQ	'=75+
57F@=C>'			P-))	P-)V)	P-)	P-PV2	P-) P	Q-V22	P-PTP	P-P)T	P-T V	P TV2	P-TV2	QQ)	P-T	V- 2
''57F@ >G'			22	2 2	22T	2VQ	2 Q	-VT	2P	2 2		QT	)Q	Q V	Q	Q)
57F] 5+ ' '			2	)	2	T)	))	)-)	2T	2T	)Q2	)2	)	)Q	)V2	)-)TQ
= 6=GG=?'				)P	)	T)		-T2T	PP	P				QV	QVP	)-QQQ
WQ6 h			T	VP	Q)T	V	Q T	)-)Q		)		Q	QP	O)0	P	)-)P
O65H B8			P)	)VT	)QV	)2	) Q	P-	PQ	)	) T	)Q	)	)P)	))Q	P-QP2
OF ++ +5AF			QPP	Q	T	P	T2	)-QTP	)QP	TP	) V	)2T	, G	)	Q2	P- 2P
			2V)	2V2	VPP '	22T	22)	-V22	2)	2QQ	2Q	2TP	VT	2	QP	)
O]E9=' ' :			)Q	)22	)Q	)	))	P- P')	))	2T	)T2	PV	)	P2V	2	P- Q
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O7 5I5?			VW	V2P	VQT	QP)	V)	2-	V T	V Q	2 2	2)V	V2	2	V 2	- T
O7 5?= +5		P	)Q	Q2	)	))	) P	)-Q)2	Q	V	TT	Q V	)V2	P	)V	)I)QP
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OC ? B= @	P- PQ	P-	P- 2	P-)W	P-))T	P)	P-PP	-P P	P-2	P- V2	P-P T	P-	P-PP	P-PQ2	P-T)	-TVP
' F=G5 7=C>	PV	V	Q2	Q	V	PV	2	)- Q2	TP	)	Q)	V	PP	)QQ	)	G6C
' F + '			2TP	2 Q	22	2PT	2	-	P2	2T2	2T	22		2 T	2V	-
' DD= 5 V'			QW	Q22	QT)	QTV	V2	2- Q	rO	QTV	V T	QTP	2OP	2 P	Q	2-)V2
'=I > 7 '			2Q	2 Q	V2		T	-2 Q	)T	2T	2 Q	PP	O 2	Q	T	)- V
' 5+ ' '			P-TV	P-T Q	P-T P	P-TQ)	P-TT	V-VP	P-TP	P- Q)	2	Q	P-P2	Q2	Q	V-TV2
' G			QV	2V		)V	)	) V2	QT	T2	V	TP	) T	)	))	)-) P
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'>++5' '			) Q	))V	))P	))	))P	P 2	))	)	PVQ	)	)T)	)TV	)P)	P-
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M + ?A8= @' '			) T	P T	)T	PQ	))T	P- Q	))P	)T	P	)T	P	)P	P22	P- T
* 57 B= @			P QVT	P-) 2	P-)	P-) T	P-PQ2	-PPQ	P-TVQ	P-T)P	P TQV	2	2	P-T	)	V-P)
* 7D= 7			2V)	2)P	P	T		-		V P	2QP	2T	VQ	Q Q	VT	-)
* 6 B= @			Q 2	QQ	QVP	Q Q	Q)	2-TVQ	VQT	QT2	QTP '	2QT	V	VV)	Q)	- 2
! =%AF5+			V	V2	QV	00	)	)-2Q2	02Q	Q	Q	)QV	T2	) V	) P	) V

PPQ QV2 PP - P PP -)V □8 PT - V QPP-2)P PTV-2PQ PT2 V PT -T)P PT)-2QT V-P V 2-Q22 -)TY VT -Q

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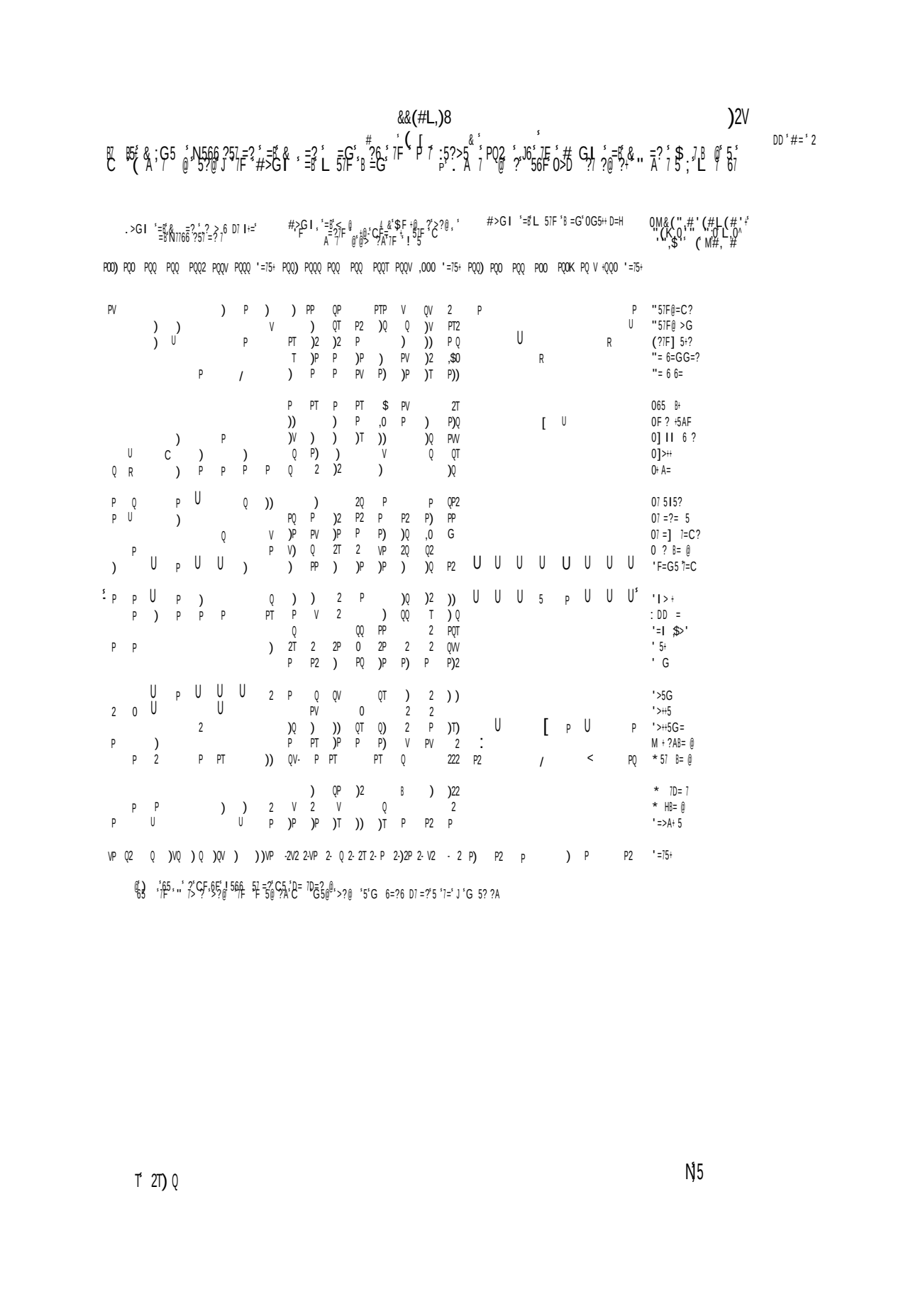

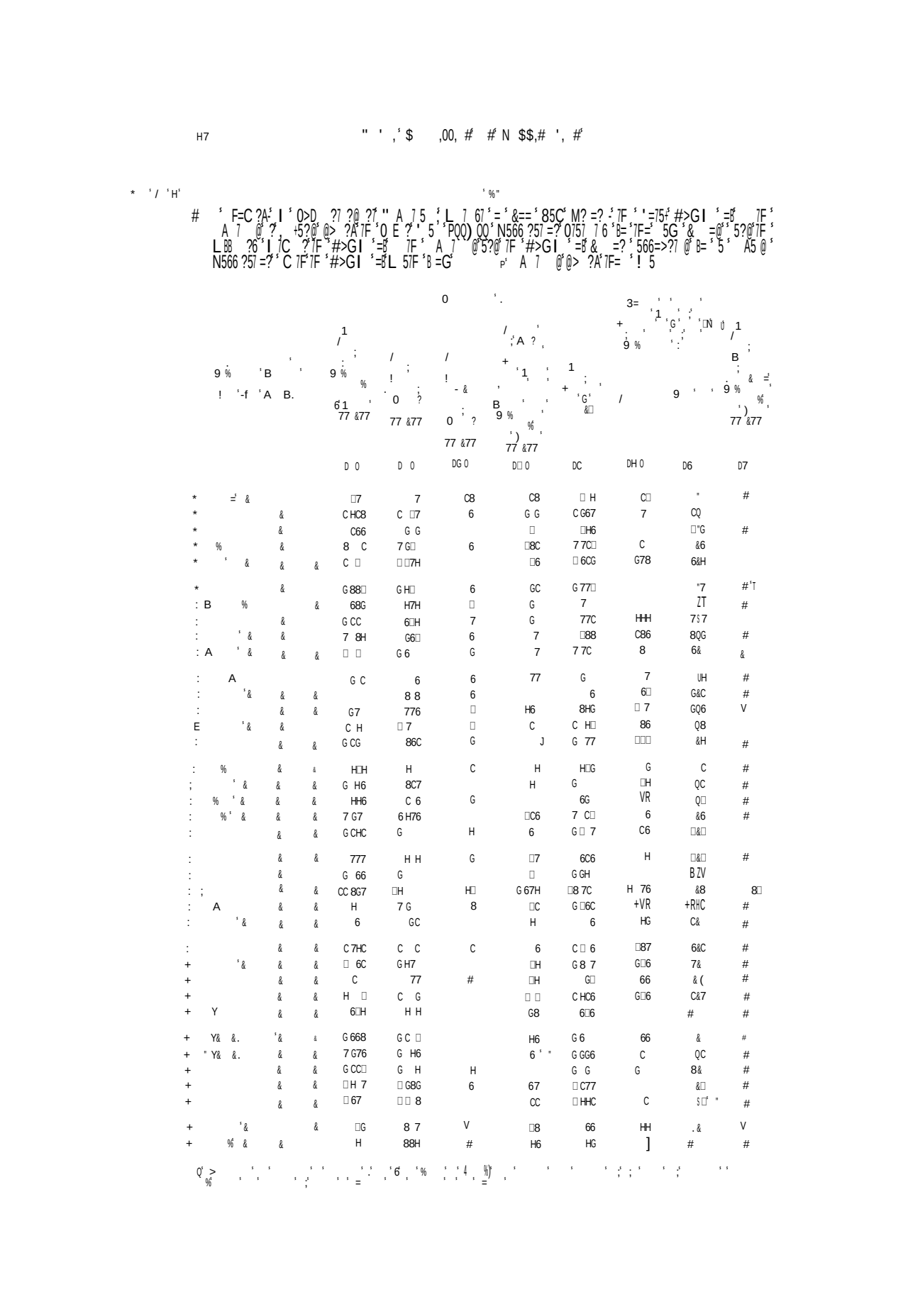

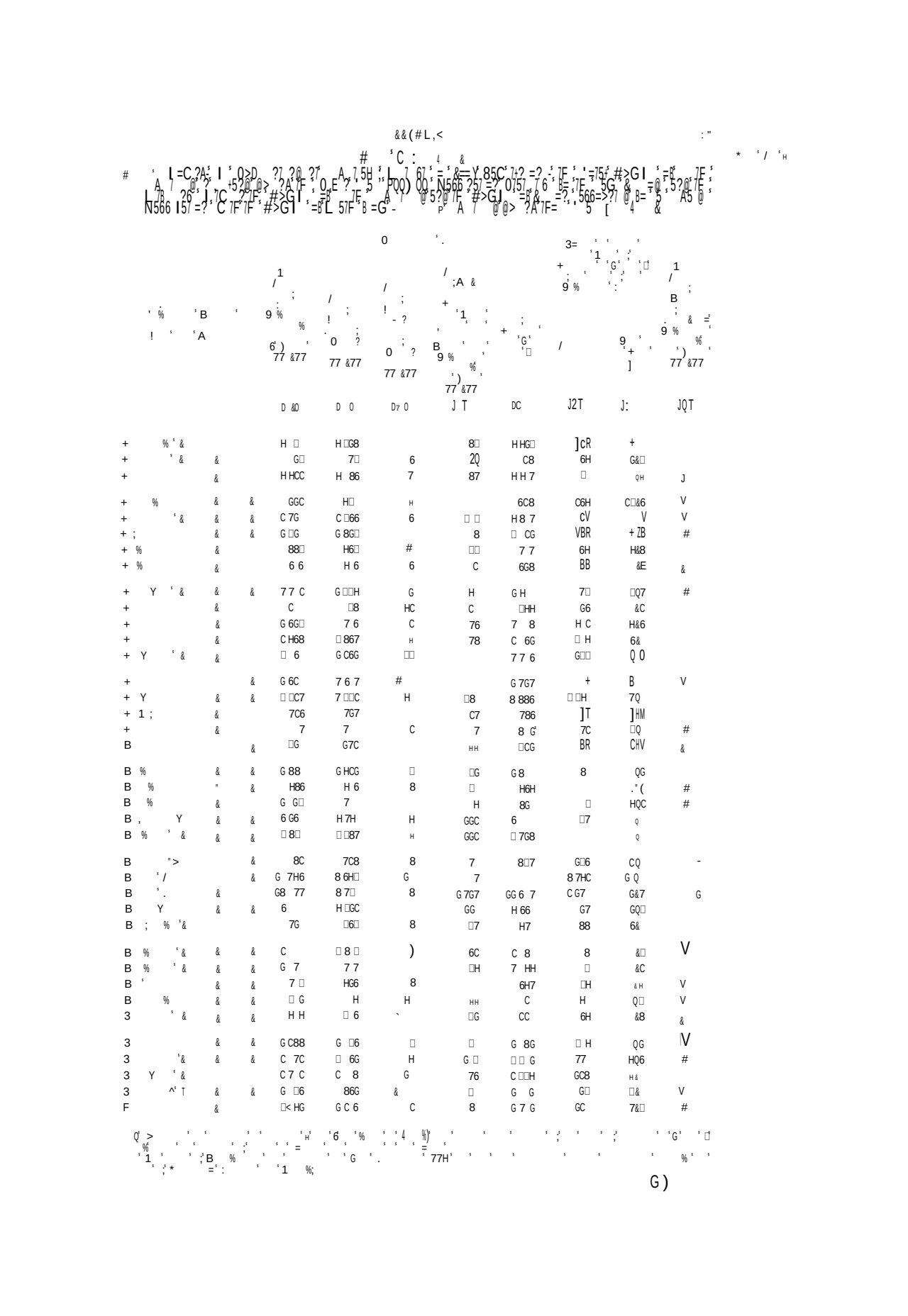

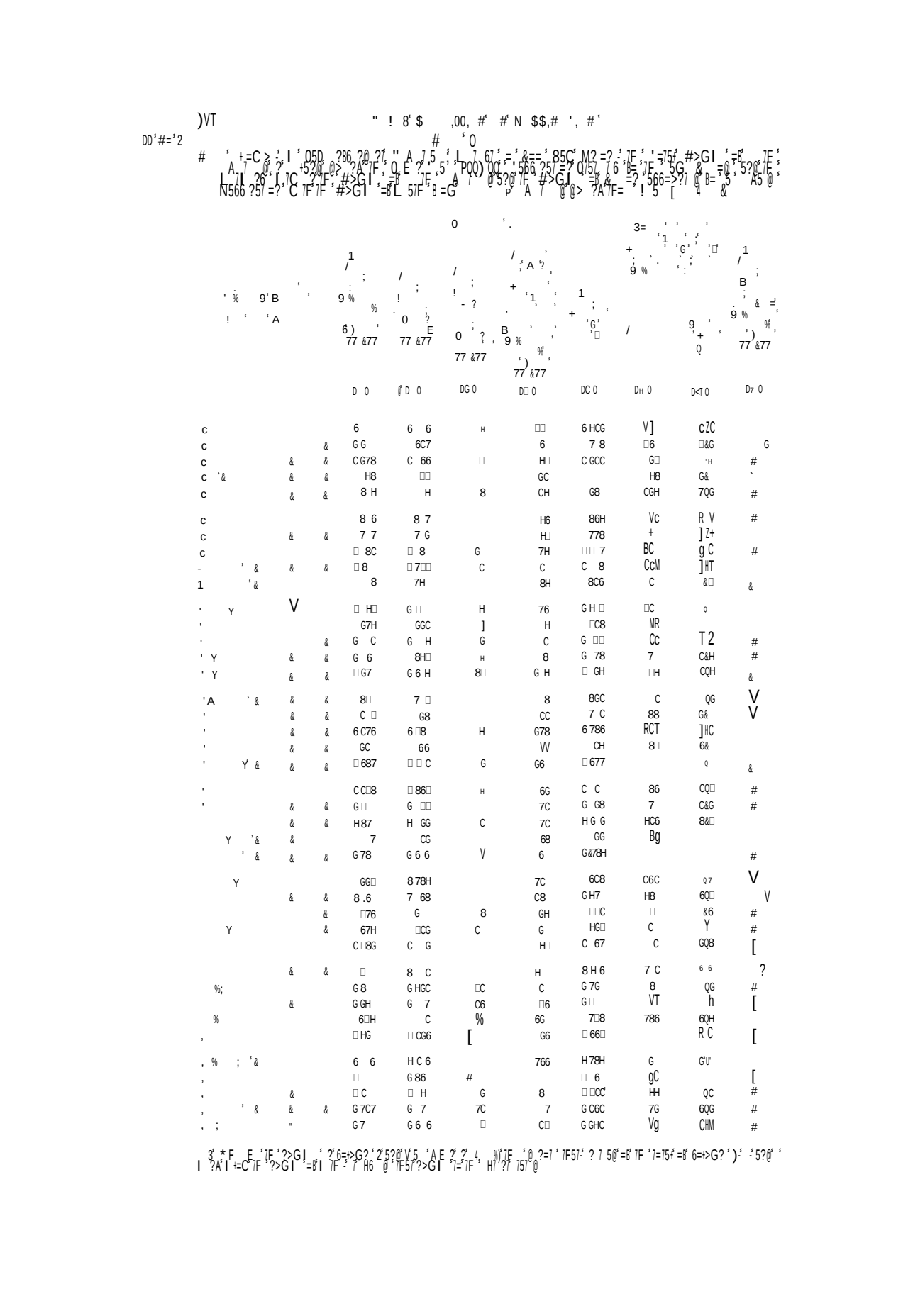

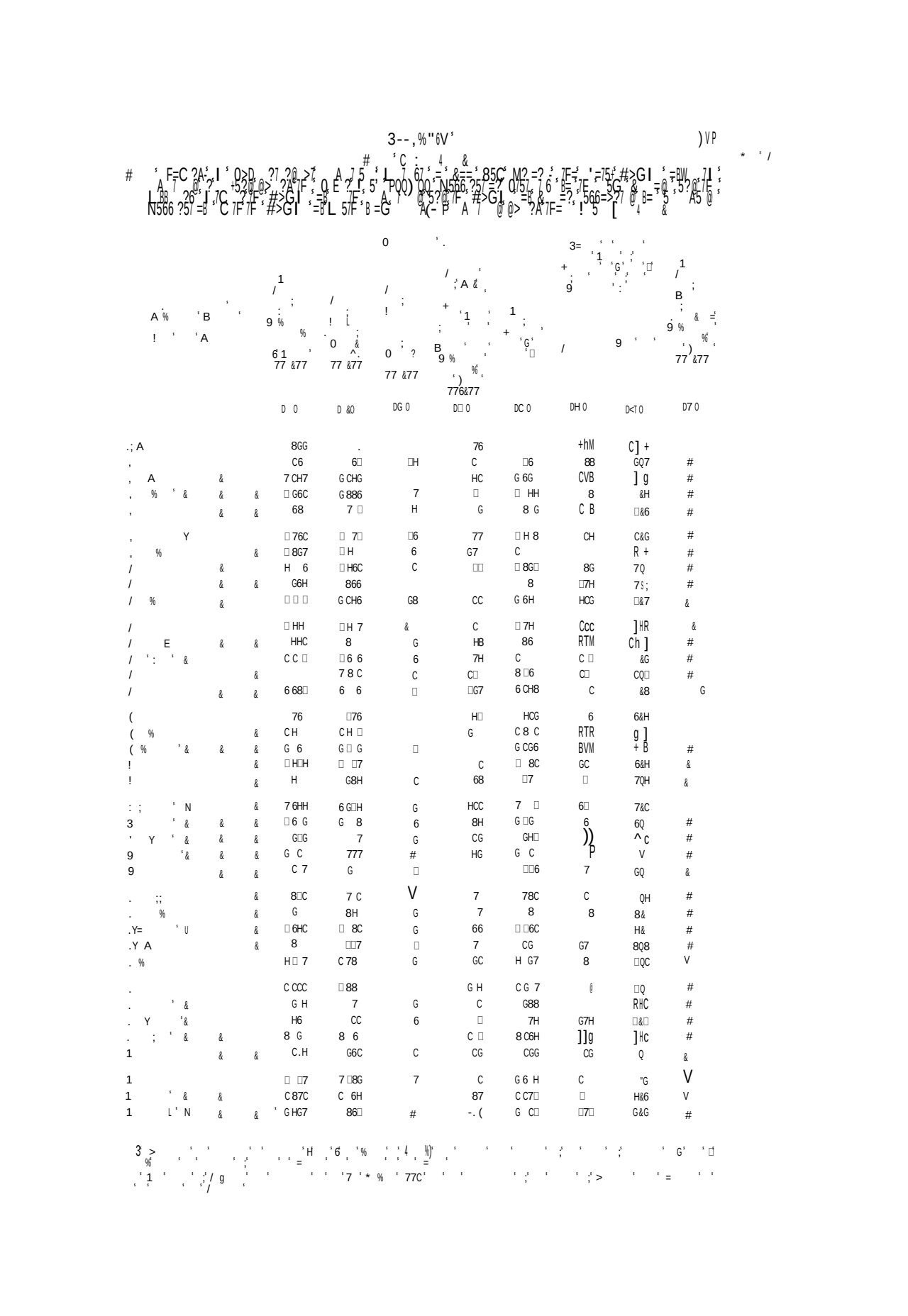

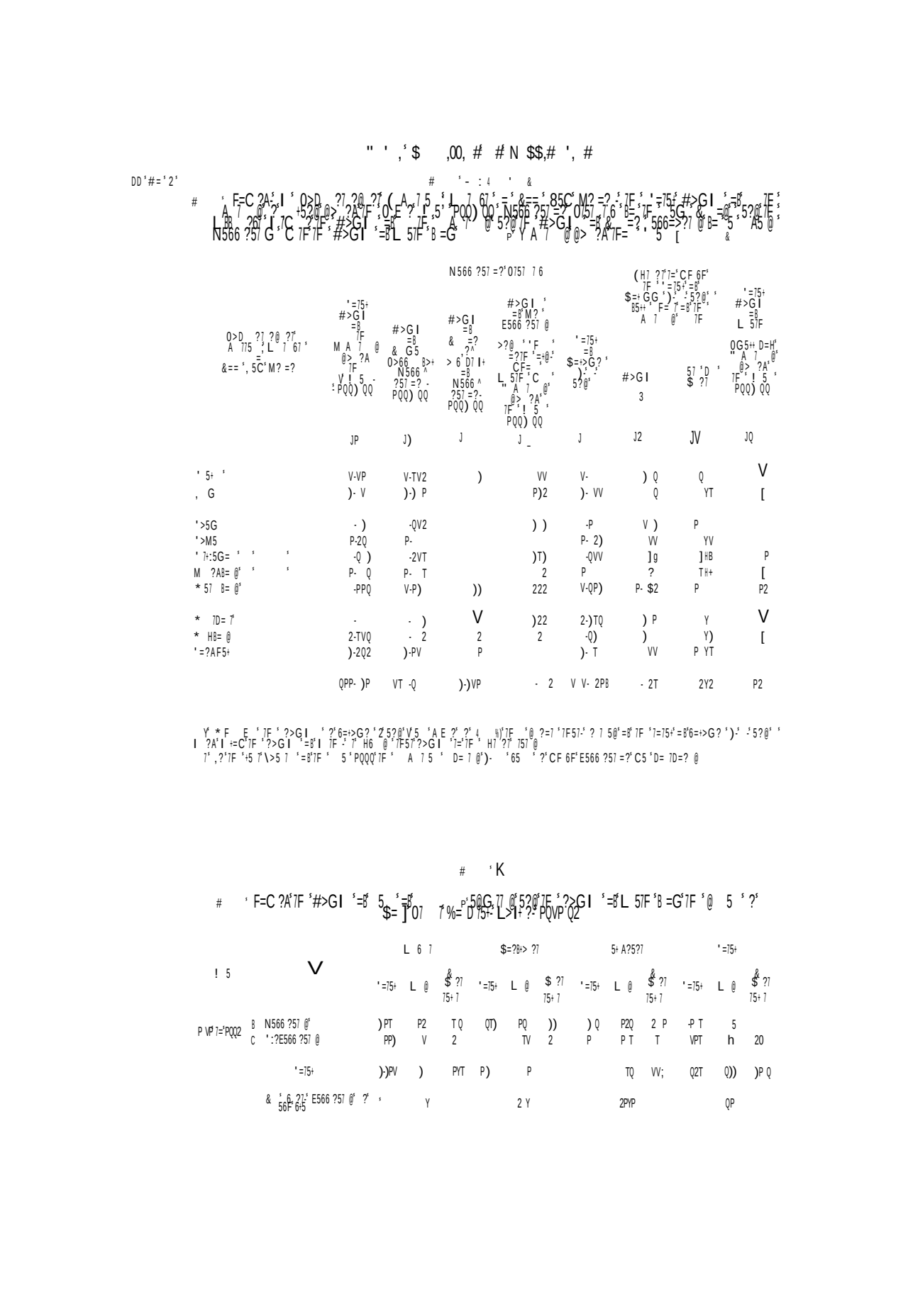

" ' ,' $,00, # # N $$,# ', #

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A 7 @' ?' +5?@' @> ?A 7F ' 0 E ? ' 5 ' PQQ) QQ ' N566 ?57 =? 0757 7 6 B= ' 7F ' 5G ' & =@' 5?@' 7F '
L BB ?67 ' I 7C ?' 7F ' #>G I ' =B' 7F ' A 7 @' 5?@' 7F ' #>G I ' =B' & =? ' 566=>?7 @ B= ' 5 ' A5 @ '
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, G	)- V	)-) P		P)2	)- VV	Q	YT	[
'>5G	-)	-QV2		))	-P	V)	P	
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' 7+:5G= ' ' '	-Q)	-2VT		)T)	-QVV	]g	]HB	P
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* 57 B= @'	-PPQ	V-P)	))	222	V-QP)	P- $2	P	P2
* 7D= 7'	-	-)	V	)22	2-)TQ	) P	Y	V
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' =?AF5+	)-2Q2	)-PV	P		)- T	VV	P YT	
	QPP-)P	VT -Q	)-)VP	- 2	V V- 2PB	- 2T	2Y2	P2

Y' * F E ' 7F ' ?>G I ' ?' 6=+>G? ' 2' 5?@' V' 5 ' A E ?' ?' 4 %)' 7F ' @ ?=7 ' 7F 57-' ? 7 5@' =B' 7F ' 7=75+' =B' 6=+>G? ')-' -' 5?@' '
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7' ,?' 7F '+5 7' \>5 7 ' =B' 7F ' 5 ' PQQQ' 7F ' A 7 5 ' D= 7 @')- ' 65 ' ?' CF 6F' E566 ?57 =?' C5 ' D= 7D=? @

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' F=C ?A' 7F ' #>G I ' =B' 5 ' =B' P' 5@G 77 @' 5?@' 7F ' ?>G I ' =B' L 57F ' B =G' 7F ' @ 5 ' ?'
$=]' 07 7' %= D 75+' L>I+ ?' PQVP' Q2

L 6 7 $=?8+> ?7 5+ A?5?7 ' =75+

! 5 V

		' =75+	L @	& $?7 75+ 7	' =75+	L @	$?7 75+ 7	' =75+	L @	& $?7 75+ 7	' =75+	L @	& $?7 75+ 7				
P VP' 7=' PQQ2	B N566 ?57 @'	) PT	P2	T Q	QT)	PQ	))	) Q	P2Q	2 P	-P T	5					
	C ' :?E566 ?57 @	PP)	V	2		TV	2	P	P T	T	VPT	h	20				
	' =75+	)-)PV	)	PYT	P)	P			TQ	VV;	Q2T	Q))	)P Q				
	& ' 6 ?7' E566 ?57 @' ?' 56F' 6+5	'	Y			2 Y			2PYP			QP					

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& =@	+-' A	T	2 PT	PT P	P)	) 2	>DC5'?@'
E 5A '5??>5-'>FGI '=B'@ 5?F -'PQ2 2	PP	P2	)	PQ		)Q	2
& Y6 ?!5A='5?' 56F'5A D =@'	PTTY	) V	+O	YQ	PVa	T	PY2
E 5A '5??>5-'?>GI '=B'@ 5?F -'PQ2h\O	Q	T	P)	V	))	)P	)V
& ?Y6 ?!5A '5?' 56F'5A YD =@'	=?Y	) V	P YT	Q	)2 T	) ;	YT
E 5A '5??>5-'?>GI '=B'@ 5?F -'PQV VQ	P	PT	2	T	PPQ	Q	P
O ?!=A '5?' 56F'5A D =@'	PTQ_	) Y	P	V	)Q 2	)T T	2
E 7 '5??>5-'?>GI '=B'@ 5?F -'POV ' 00	) 2	22	)	P2	2	2	P2
& 6 ?!5A6'5?' 56F'5A D =@'	PTTY	) YQ	YQ	2	) T	)2	2)
PQQ	P			' '	P		
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PQQV	P	P	)				
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E 5A '5??>5-'?>GI '=B'@ 5?F -'PQ2 QQ	QT	PP	T	T		QT	PQ
& 6 ?!5A='5?' 56F'5A D =@'	PTT	) V	P)	VY	) V' -	)PYP	Y
B 5?' 'e 6 'G +M6?' + E ?A'	V)	PQ	QT	Q		2	?

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' F=C ?A' 7F='' % ' $' =B' " '5?@' 7F ' A '5?@' '566 ?5?' =?5-' $=?@ 7 =?' =B' & =? ' CF='' @ @' B =G' P' ?' , +5?@' @> ?A' 7F ' Q' 5 -' PQQP QQ

N?66 ?5?' =?5-' $=?@ 7 =?	+-' A	T	PT	PT P	P)	)	>DC5'?@'
N566 ?5?' @'	%	Q	Q	V	)P	QP	
MG 566 ?5?' @' ' ' ' ' _	2	PT	)		P	PT	
#='7 7 G ?!'	P P	)	2	PT			P
' =?5-'	) P	P	PP	PV	V	V	P

'8

' F=C ?A' B=' , +5?@-' I ' A & =@ ' 7F ' E 5A ' ??>5-' #>GI ' =B' L 5?F ' B =G' C 1 $J' A 7 @' > ?A' 56F' 9> ?\> ?? >G' =B' 7F ') ' 5 -' PQ2 QQ ' C 7F'7F 'G 5?' 5 + ' #>GI -'5?@' 7F ' E 5A ' ??>5-' "5? 'D ' ++ =?' + E ?A'B= '7F= ')' ' 5

_' ' DF> -'7 DF= @-'5?@' GD+ '6=?7 ?> @' B E

& =@	+-' A	T	PT	P P	P)	)	MDC5'?@'
E ?A '5??>5-'?>GI '=B'@ 5?F -'PQ2 2 '		V	))	)QQ	Q)V	P-TQP	P- V
& 6 ?7=A '5?' 56F'5A D =@'	PTTY	V	VY	2Y2	PQ Q	))	2Y)
E 5A '5??>5-'?>GI '=B'@ 5?F -'PQ2 V '	-)T	) V	)QT	)QP	2Q)	V)V	2
& 6 ?!5A '5?' 56F'5A D =@'	PTT	Y)	QY	QYQ	)P	))YV	))
E 5A '5??>5-'?>GI '=B'@ 5?F 'PQV VQ' _	)-Q	) 2	)	) Q	VT	22)	V T
& 6 ?!5A '5?' 56F'5A D =@'_	PTTY	Q	Q 2	Q 2	) Y	))YQ	)VY)
E 5A '5??>5-'?>GI '=B'@ 5?F -'P2V Q '	)- Q)	P	B+	))	2)	2)	2 2
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E 5A '5??>5-'?>GI '=B'@ 5?F -'PQQ Q'	P-2P	P P	P	P	TV		Q
& 6 ?7 6'5?' 56F'5A D =@'	)TT	QYP	Q	#	))	) Y	)
E 5A '5??>5-'?>GI '=B'@ 5?F -'PQ2 QQ'	)- Q	)	) 2	)	2	2	Q2P
& 6 ?!5A '5?' 56F'5A D =@'	PTTY	Q	Q	QY'Y a	)) :	) YV	) O
5?' 'D 'G M =?' + E ?A' ' ' _'		V	)	T	2 P	2	V T

DIAGRAM ILLUSTRATING TABLE H.

DIAGRAM *shewing for the Dublin Registration District the total number of Deaths for each year from 1864-88 both inclusive; the average number of deaths for the 25 years 1864-88; the average number of deaths from Diseases of the Respiratory organs, and Consumption (1864-88), and the number for each year; the annual number of deaths from all Zymotic diseases, and from Fever, Diarrhœa, Scarlatina, Small-pox, Whooping-Cough and Measles respectively (1864-88); and the number of deaths from Cholera during the Epidemics of 1866.*

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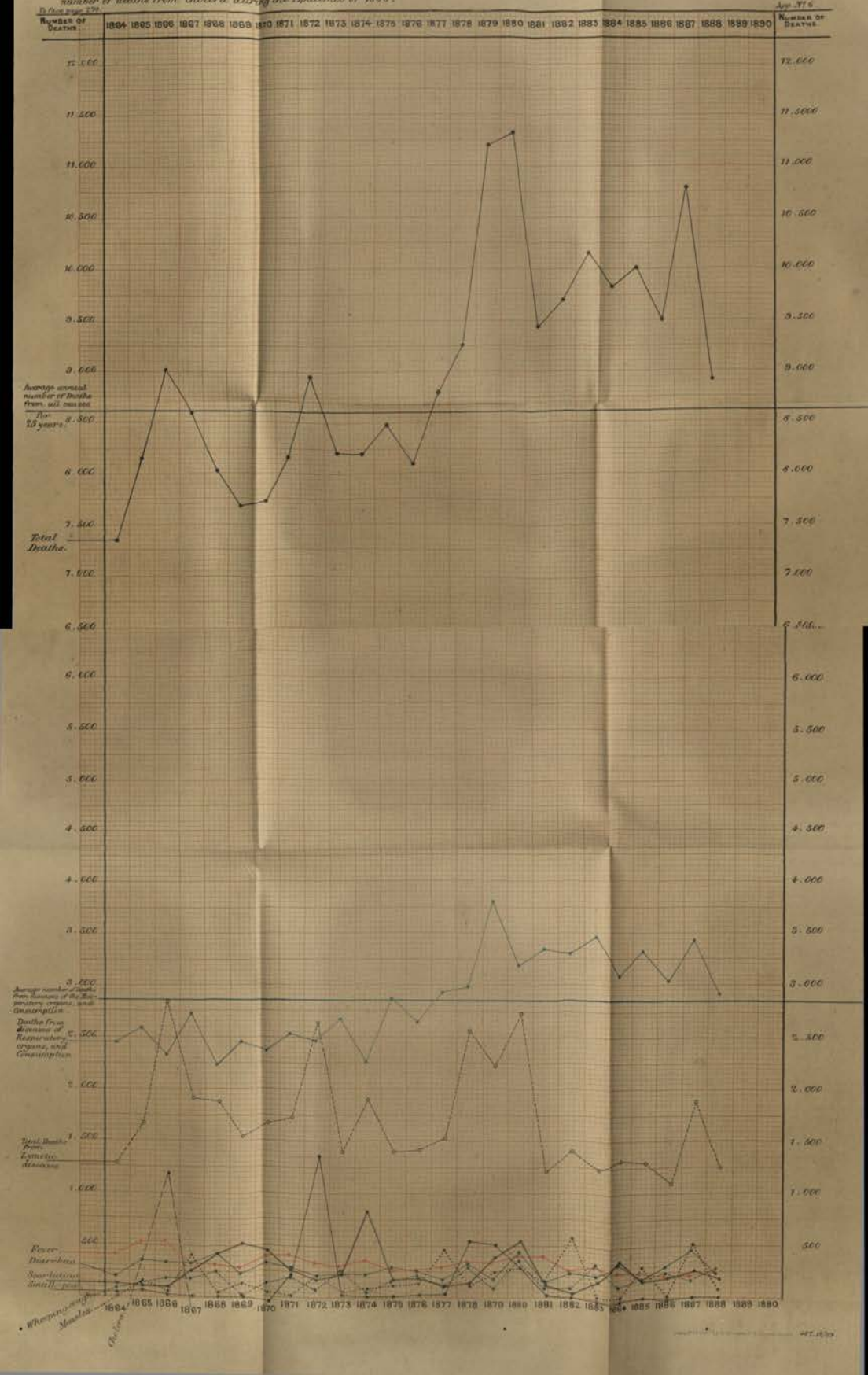
App. N° 6.



EQ

' F=C D '7F '%' '=B'" 'B =G',?B5?7 + ' ' A 7 @' ?', +5?@' ?'7F ' 5 'PQ2 QQ

DD ' # = ' 2

A

! 5	' ?@ 'P' ! 5	P'5?@'>?@ 'Z' ! 5		' =75+	K, ?_ =75+ 5+	L 5?F ?' a D F ?'1' ' 8 Z ! 5 A
	5+ & > 5+	5+	0 G5+	%5+	0 G5+	
,Q$	2P	V	0	2Q	PTV	P2PY)
PQO	2P VQ	V	2	2Q Q	P P	)T Y
P 2	V P			T	' V	PP YQ
PQ2V	2 =	V	2	2	QQ	P YV
PQ2Q t	) QV	2		Q P	V	P)TY
PQ2 '	Q) P	)	)	P	2V	PT)Y2
PQVT	) P		)	)Q 2	2	QYT
PQVP	QP)P	2	T	2 0	22	PTPYT
PQV)	QT)T	) a	P	Q))P	2	QPYP
PQV	) 0	P	V	T V	2V	PT)Y2
PQV	)2 PT		'	) ' _	) P	VQP
PQV''	)V)			T)Q	2Q	QQ Q
P2V2	))T		0	))Q		T Q
PQVV	)) H		2	))P	2	V Y
PQVQ	PV)T		0	)T)		V YV
PQV ' ' _	))V	P	2	QT	T)	PTVY2
PQQT	_)Q S		7	QP)	2T	
PQQP	) QP		)	)V +R	2T	PT Y
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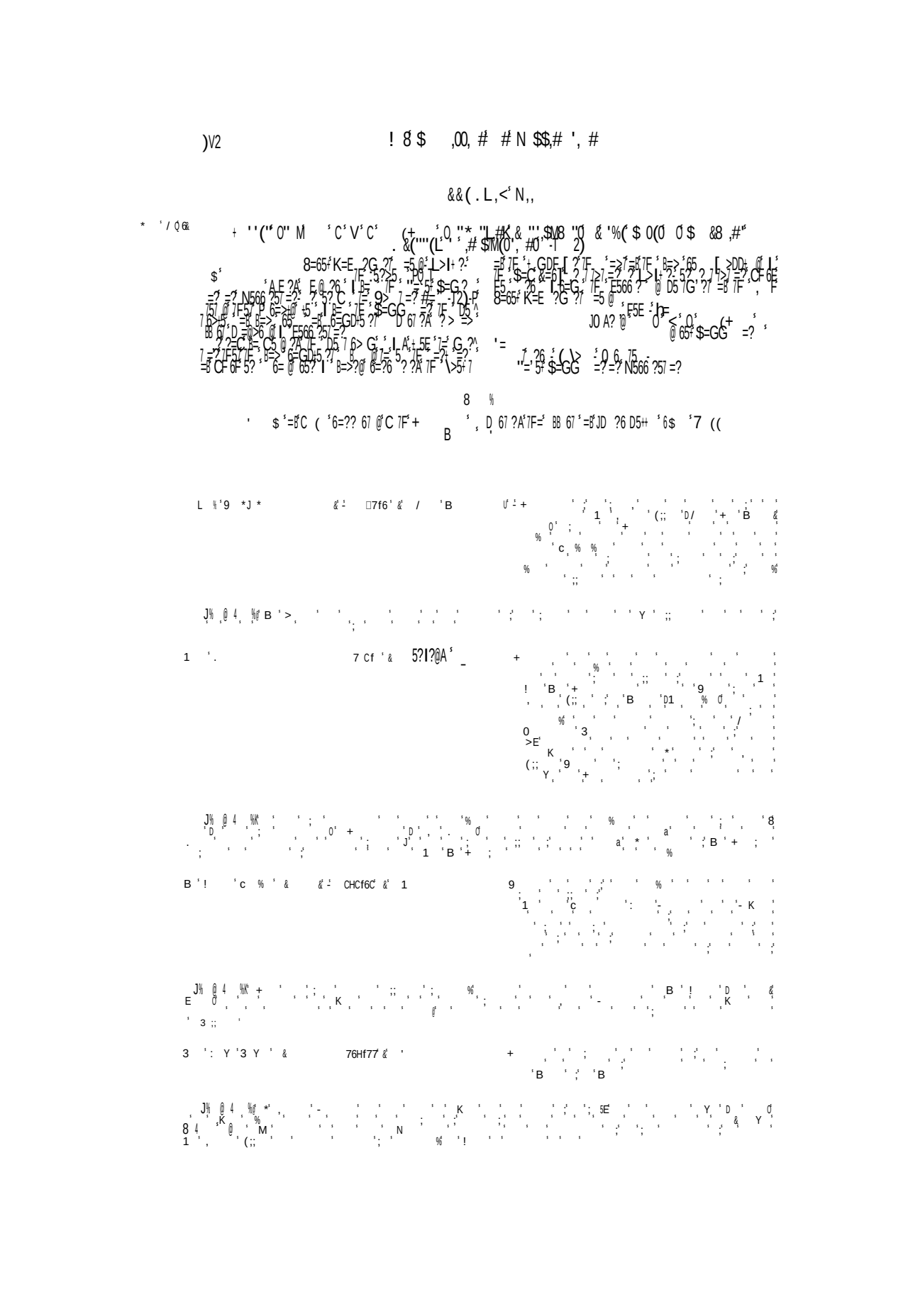

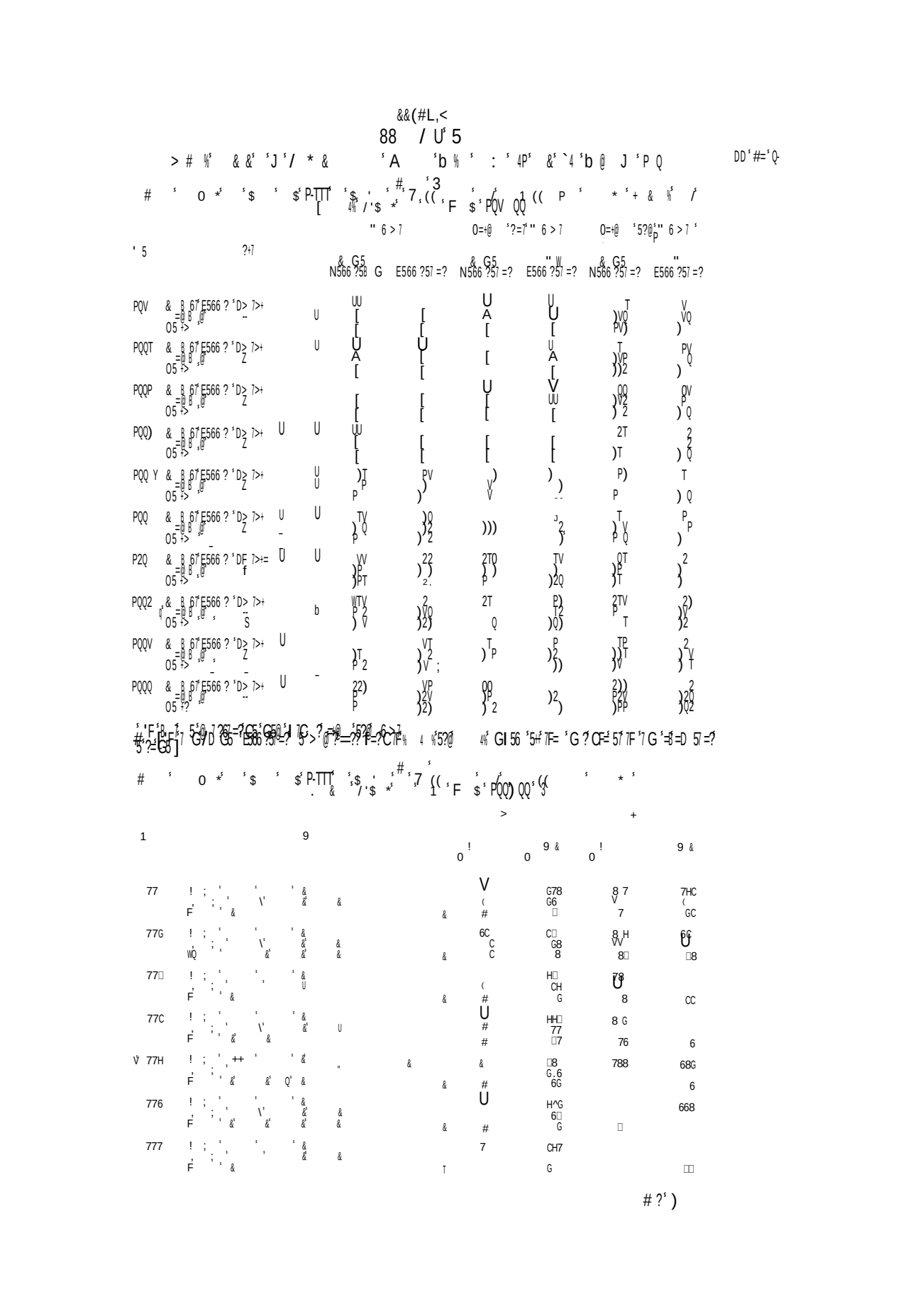

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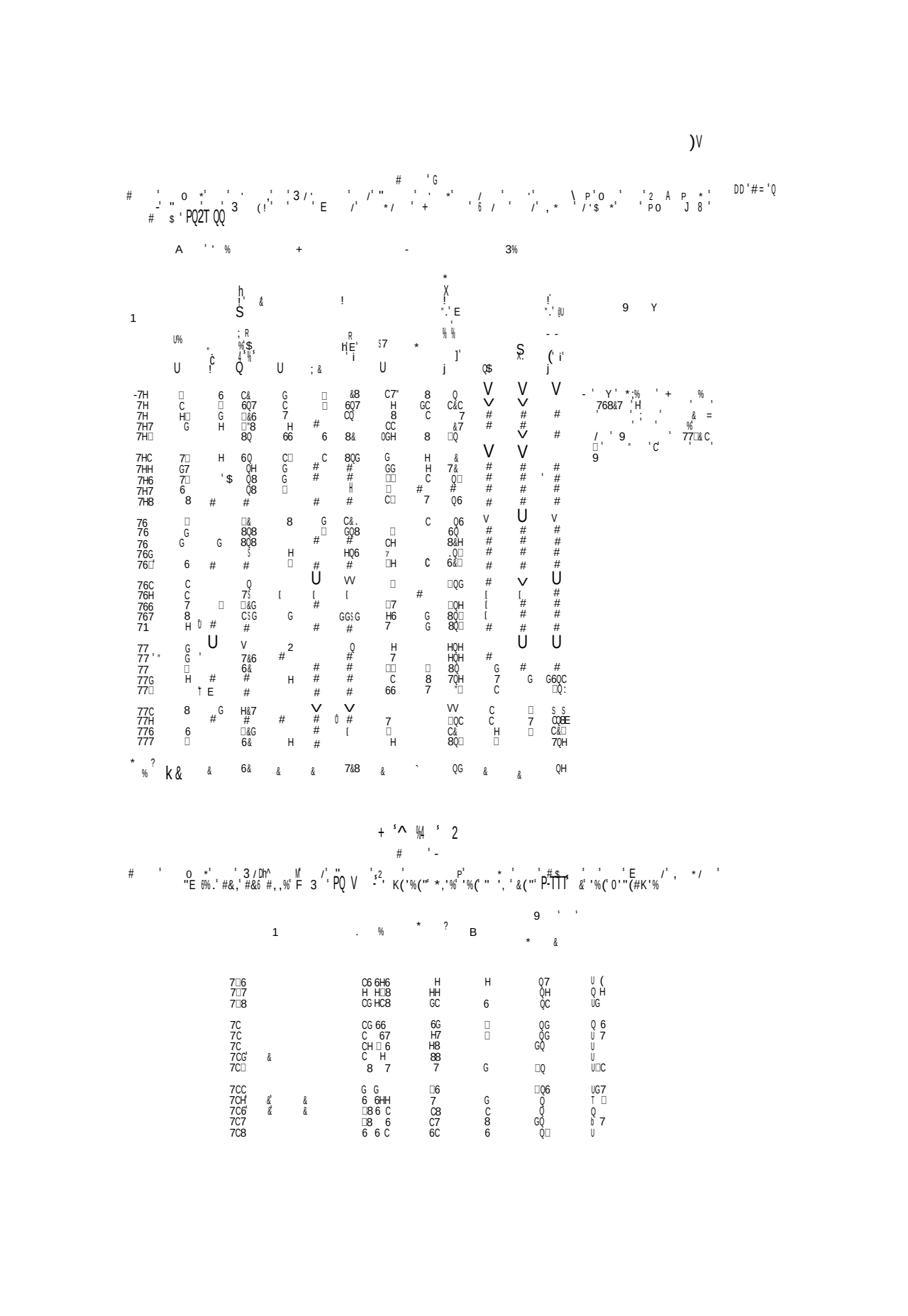

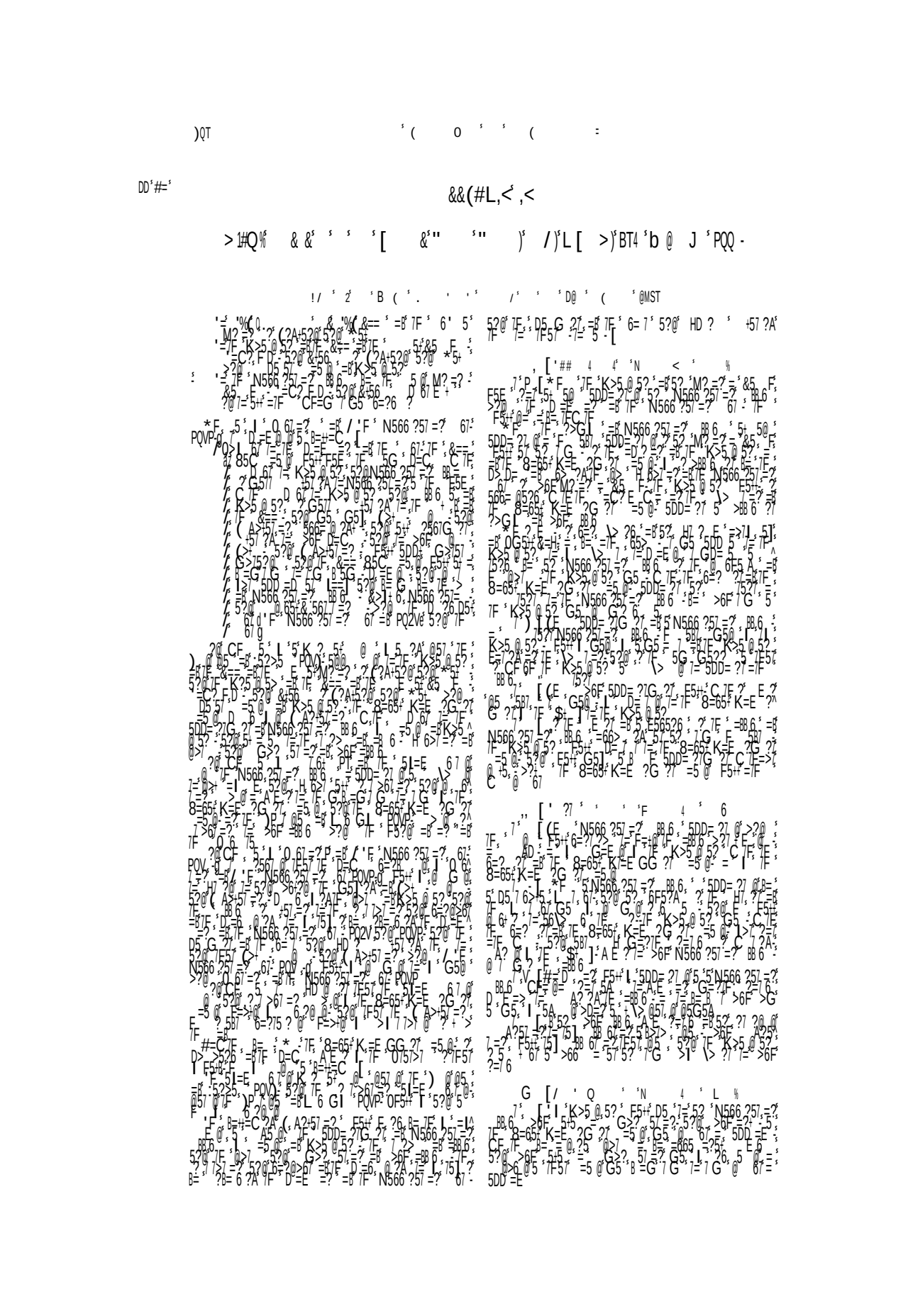

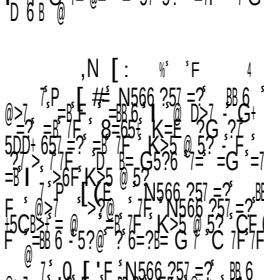

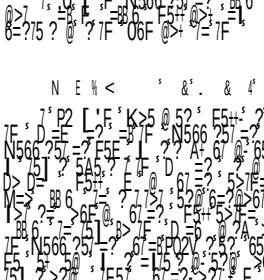

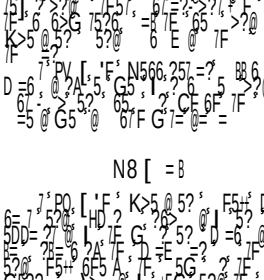

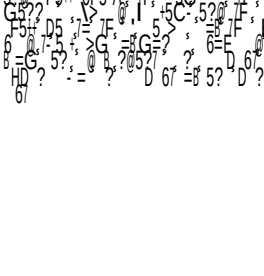

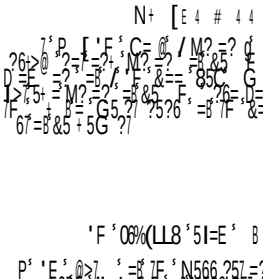

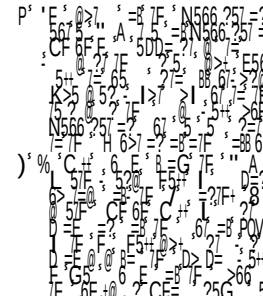

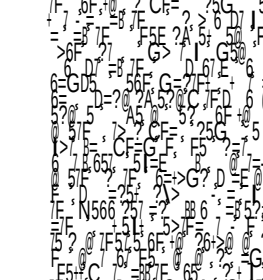

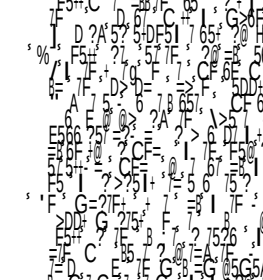

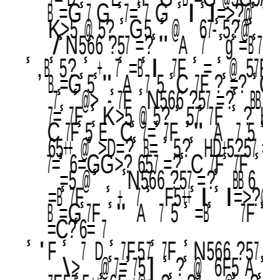

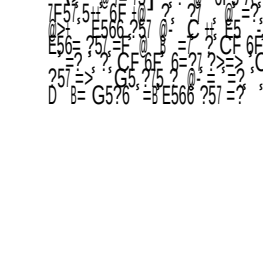

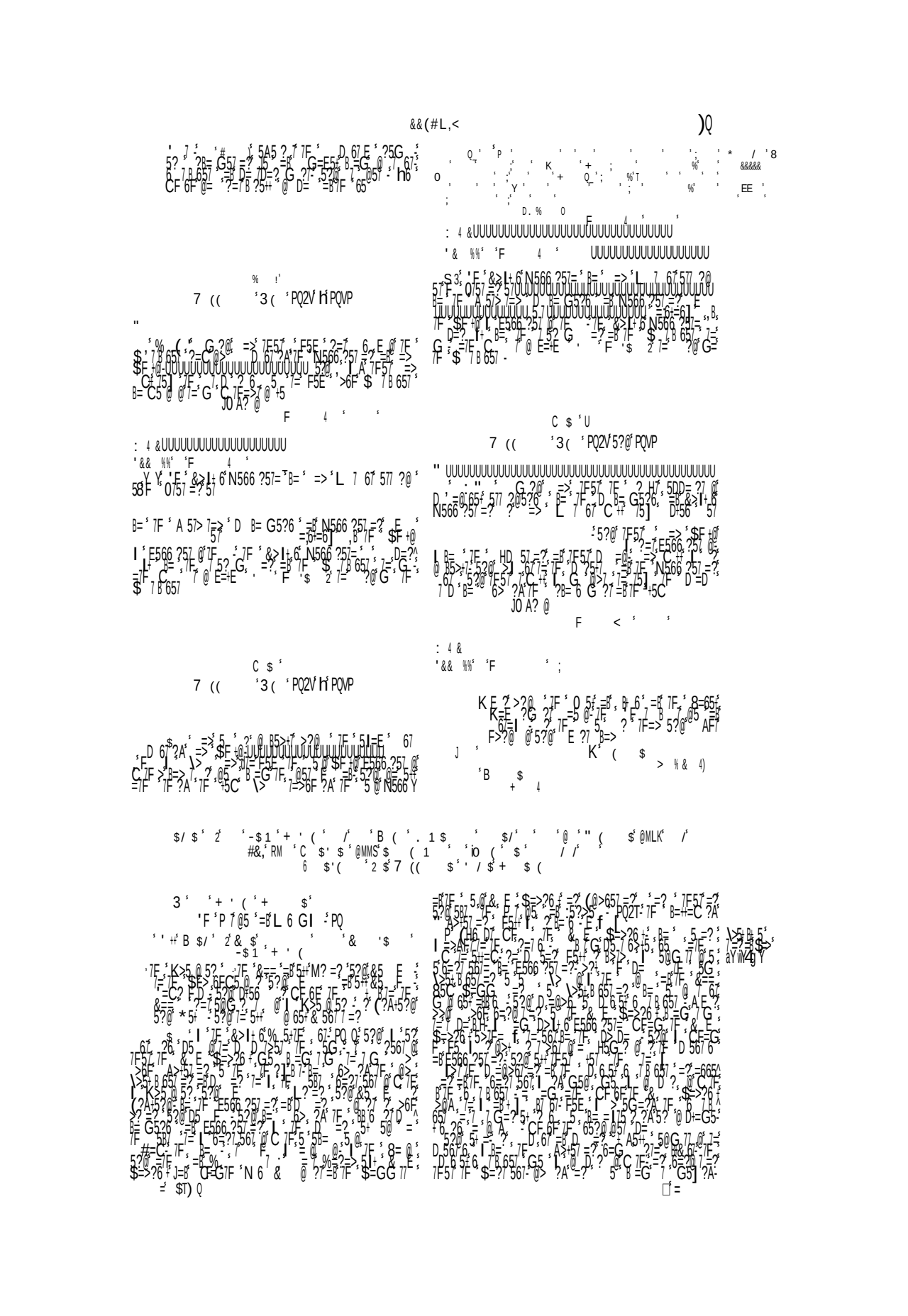

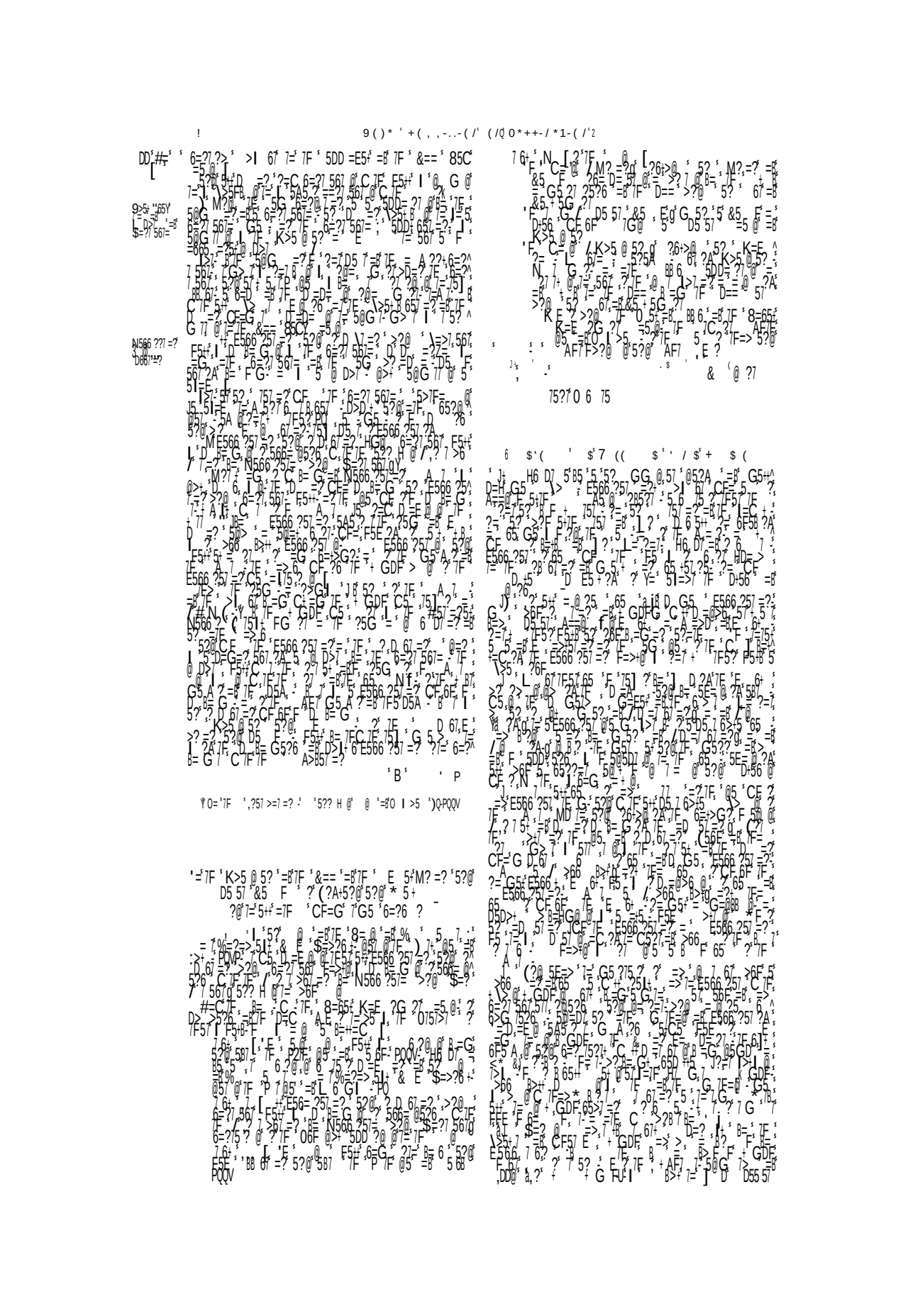

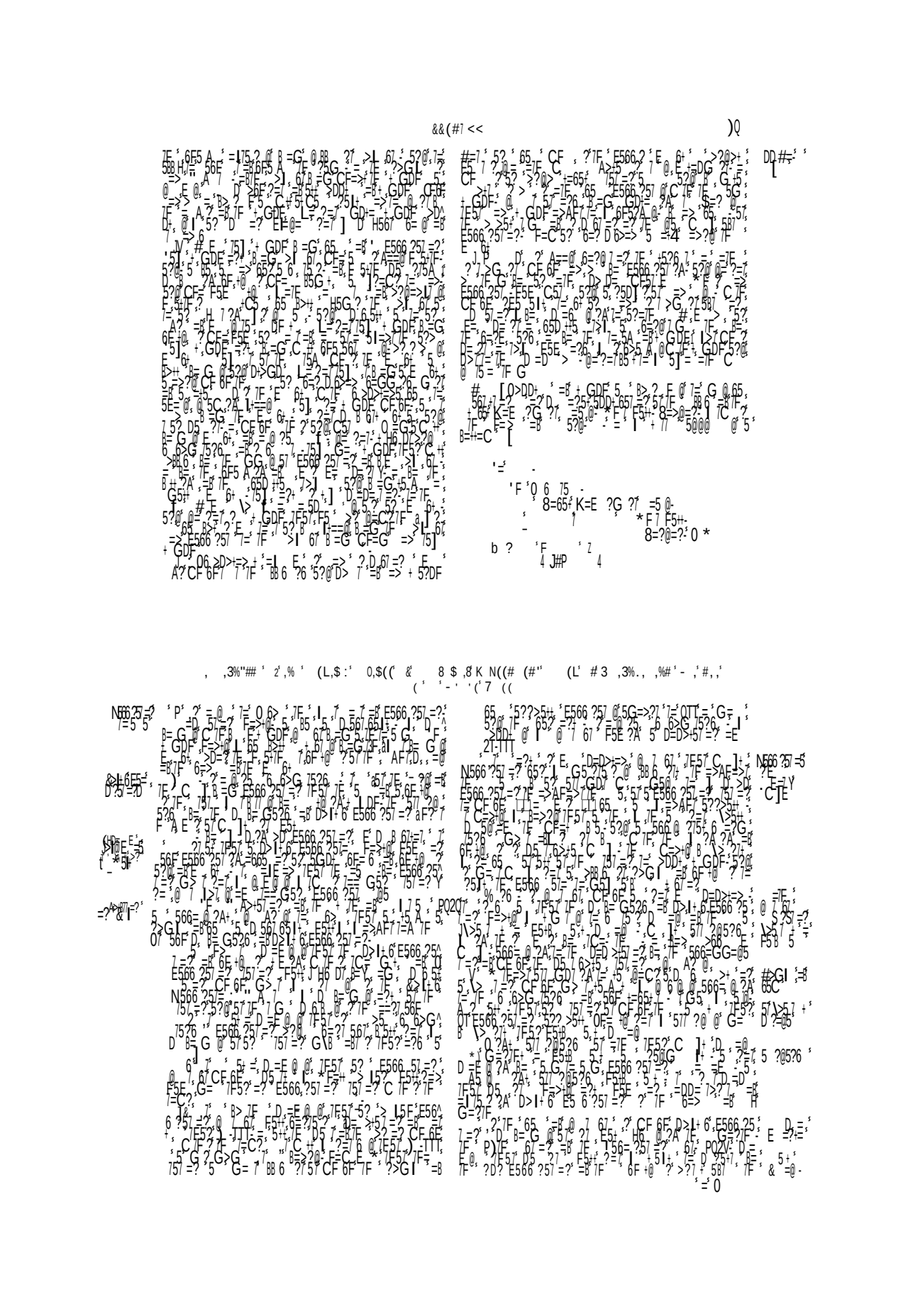

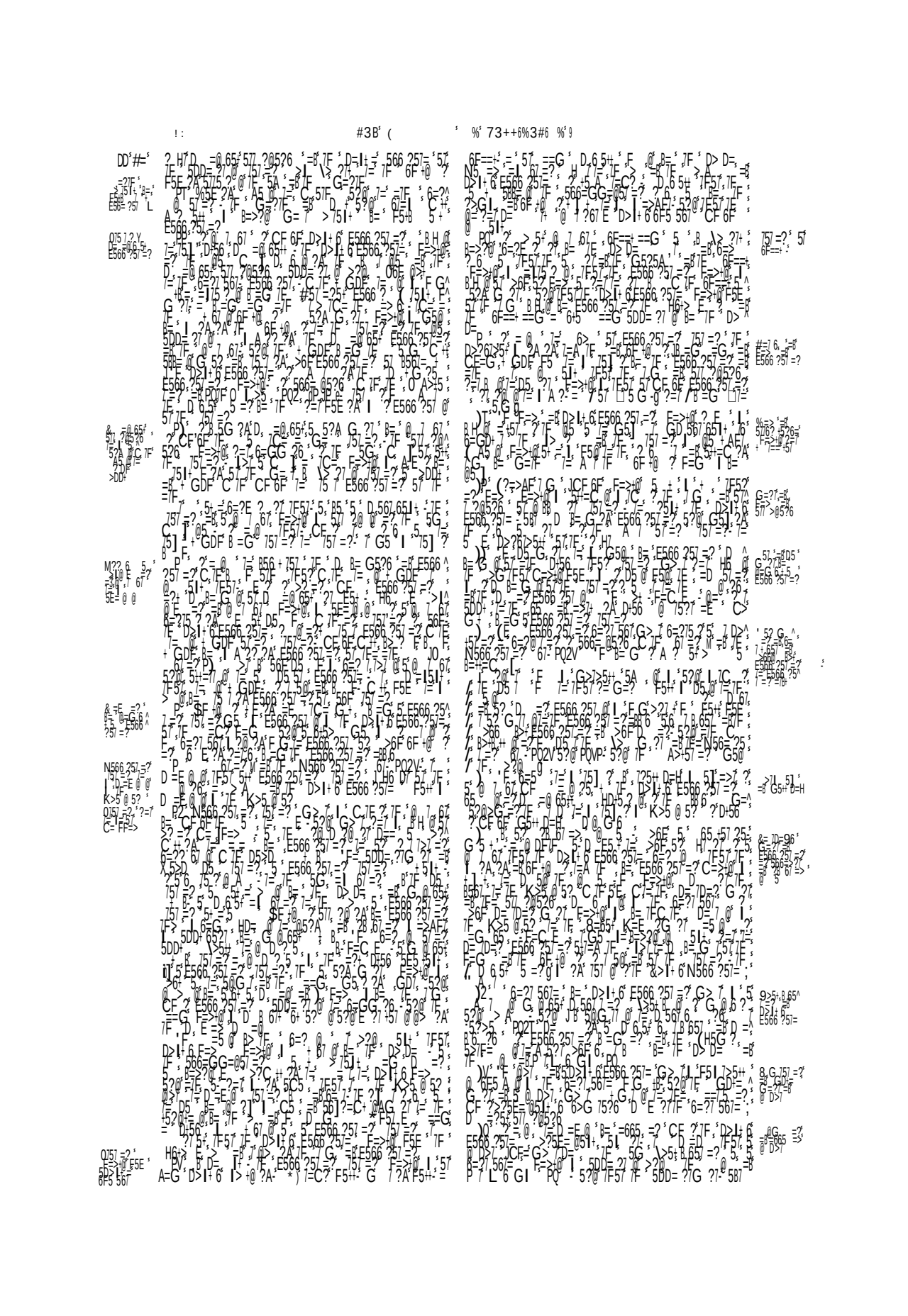

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CF 5? 5D @ ' 7F ' E ' D> ' 7 ' 5?@ ' 7F =5?@ ' 2A ' C ' 7F ' 5?@ '
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G ? ' 5 ' C ++ 5 7F ' D =A ' ' D ' 7 ' D5 5? ' = ? ' C5 ' G = 5 '
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566 = GD5 ? ' B ' = G ' A ' @ 6 5 ' ' @ B = G ' 5 ' ' 5 7 ' 7 '
D56 ' E ' 5DD 5 5?6 ' @ ' C ' 7F ' 5 ' C ' 7 ' 5 ' 7 '
7E ' E 7F @5 ' C ? 7F ' 5 ' G ' 5 ' 7 ' 5?@ ' 7 '
6F ' 6=?7 ?> ' @5 ' C ' 7F ' 5 ' G5++ ' 6 ' 7F ' F '
>?@ ' 7F @5 ' 65I ' ? 7F ' C ++ 5 ' 7F ' 5?@ ' 7 '
26 ' 5 ' @ ' 6 5 ' ' @ ' 5 ' 7 ' 7E ' ? B ' 6 ' 7 ' 5DD '
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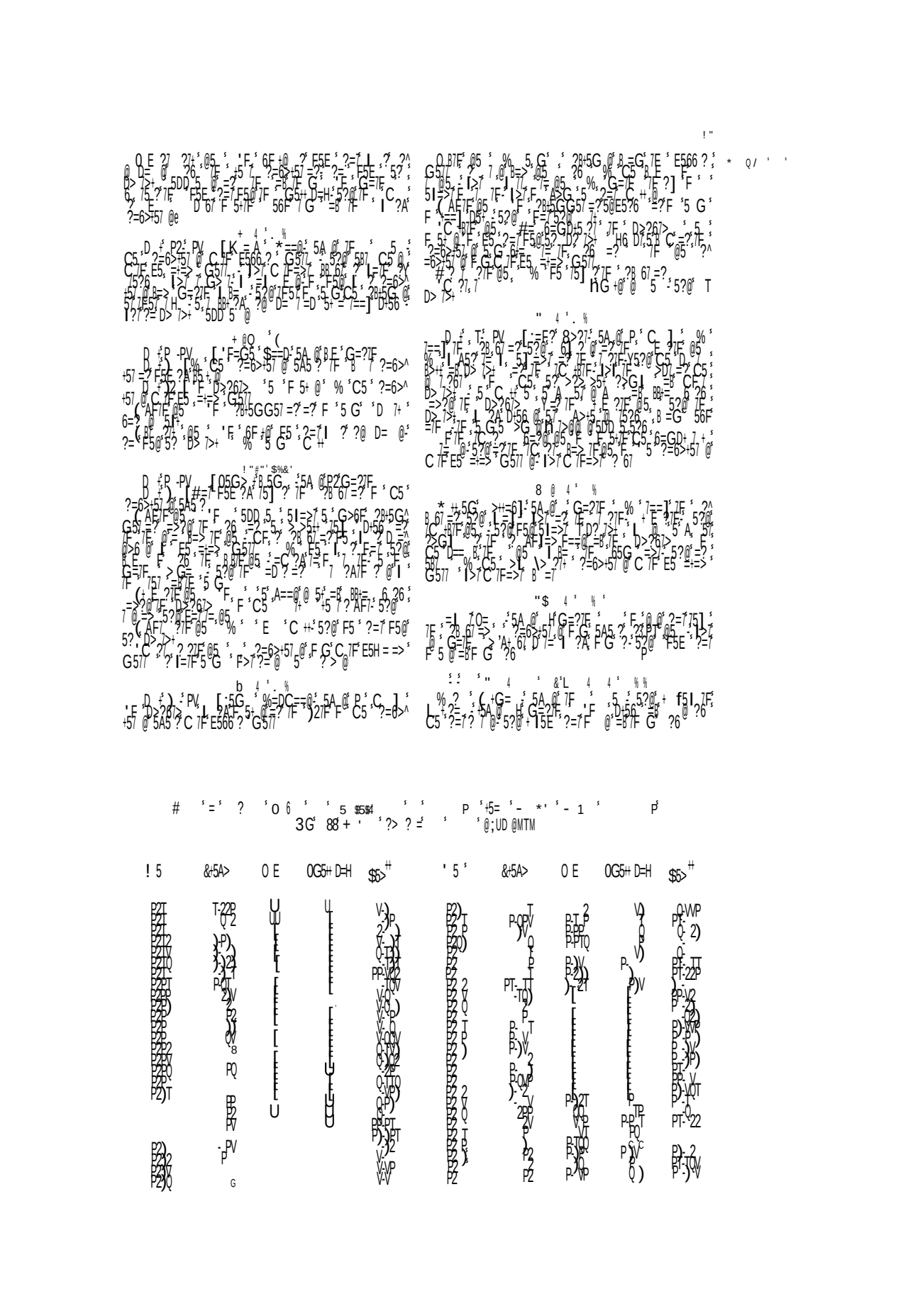


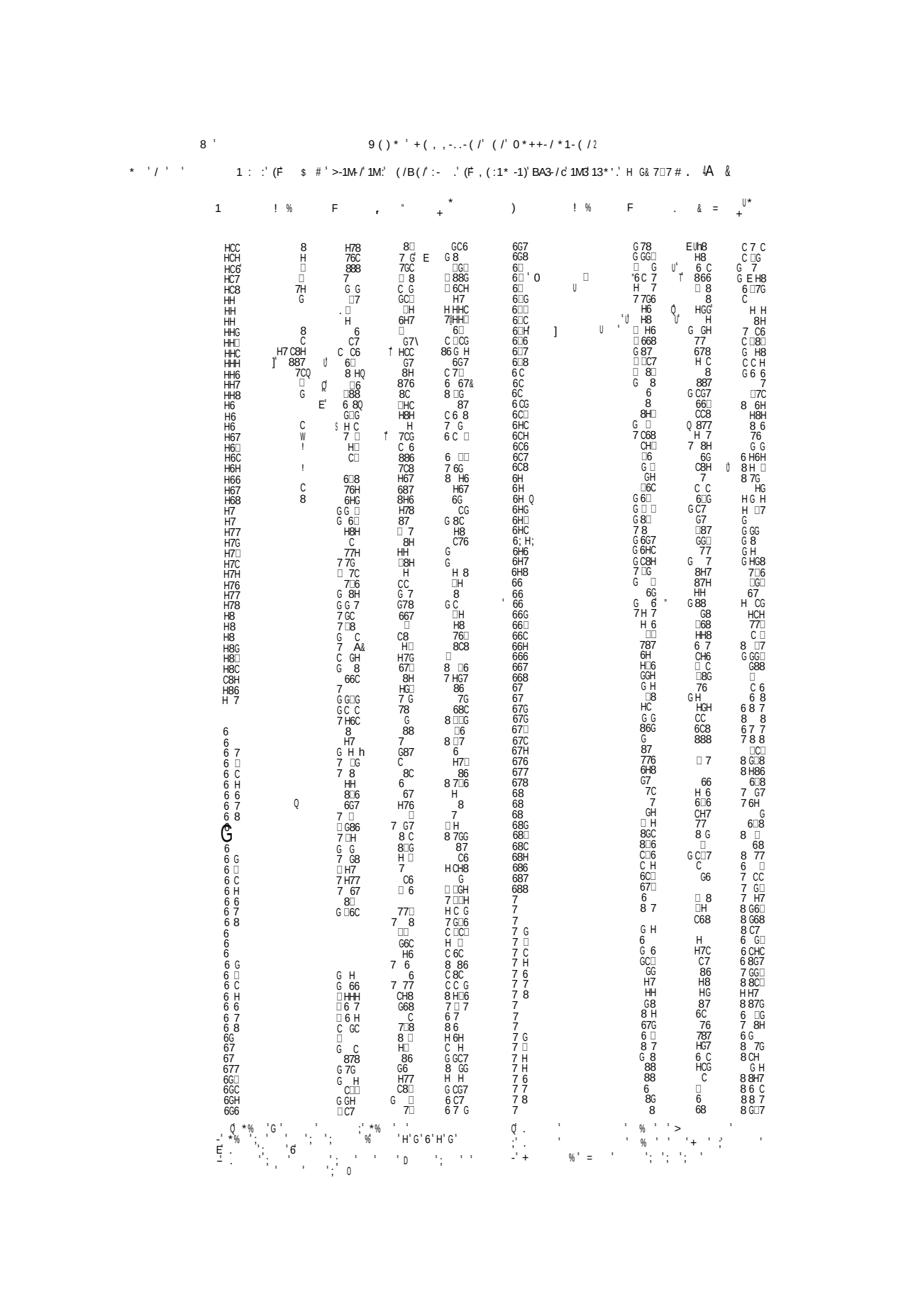
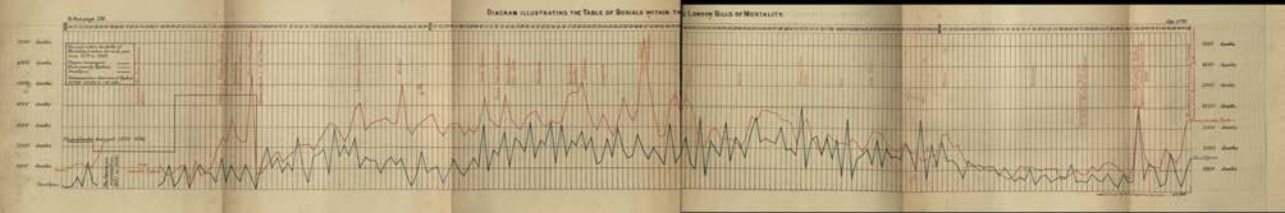


DIAGRAM ILLUSTRATING THE TABLE OF BURIALS WITHIN THE LONDON BILLS OF MORTALITY.



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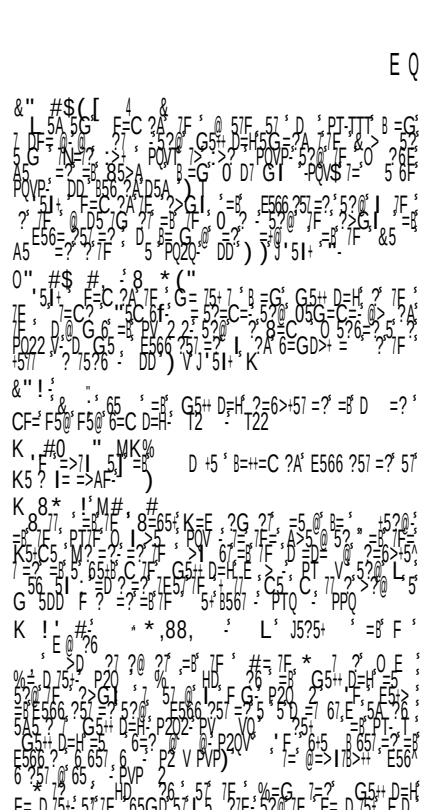

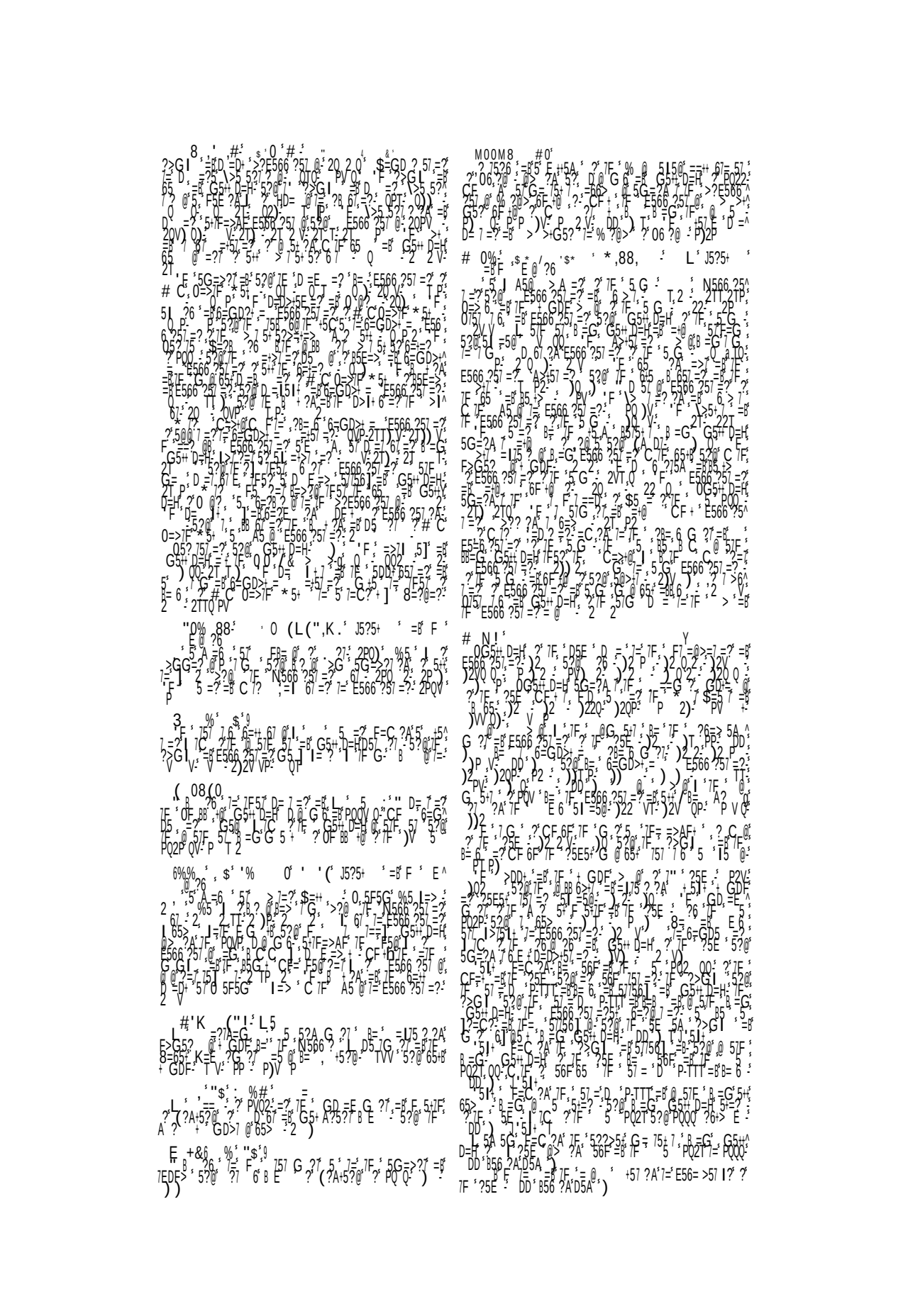

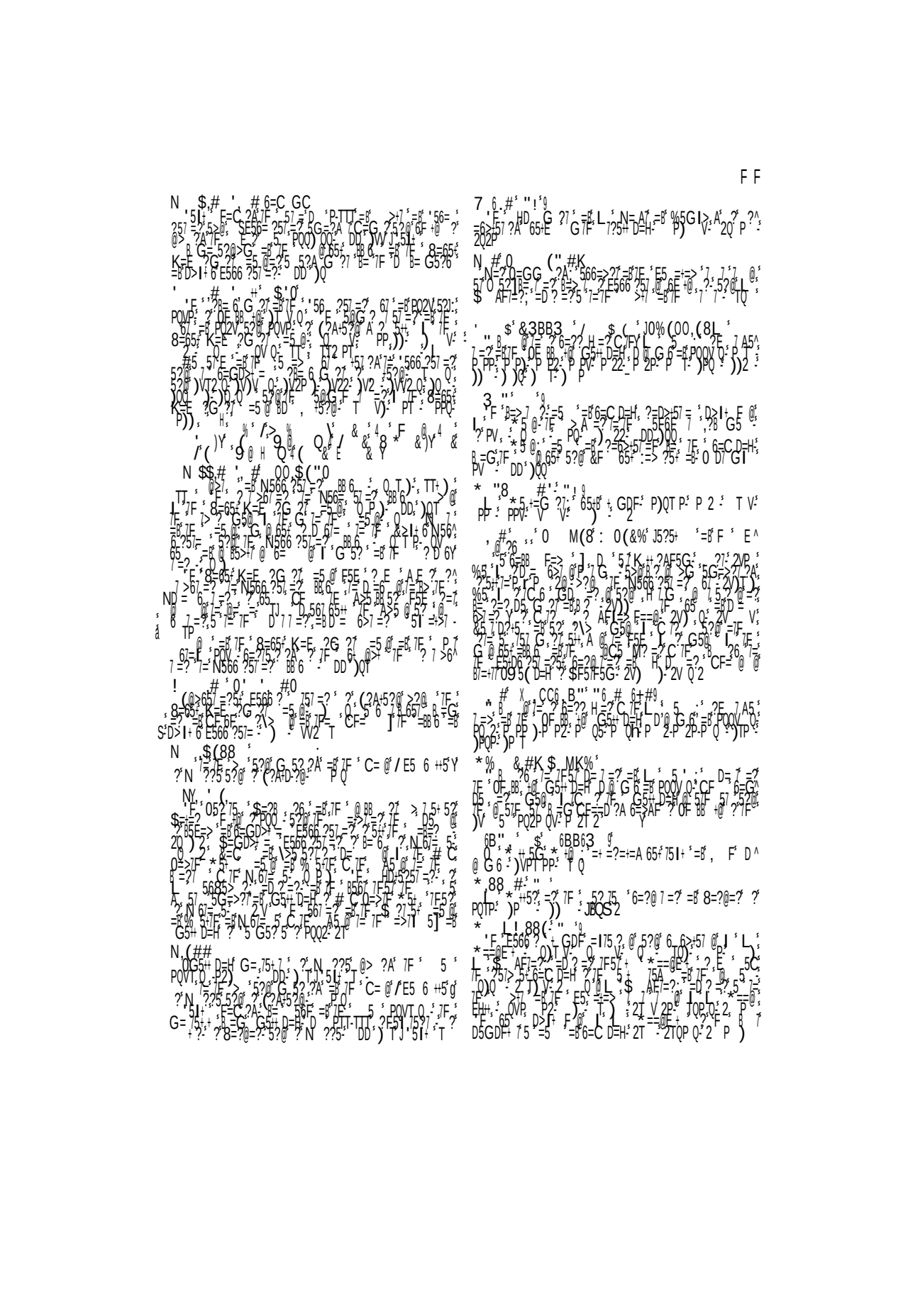

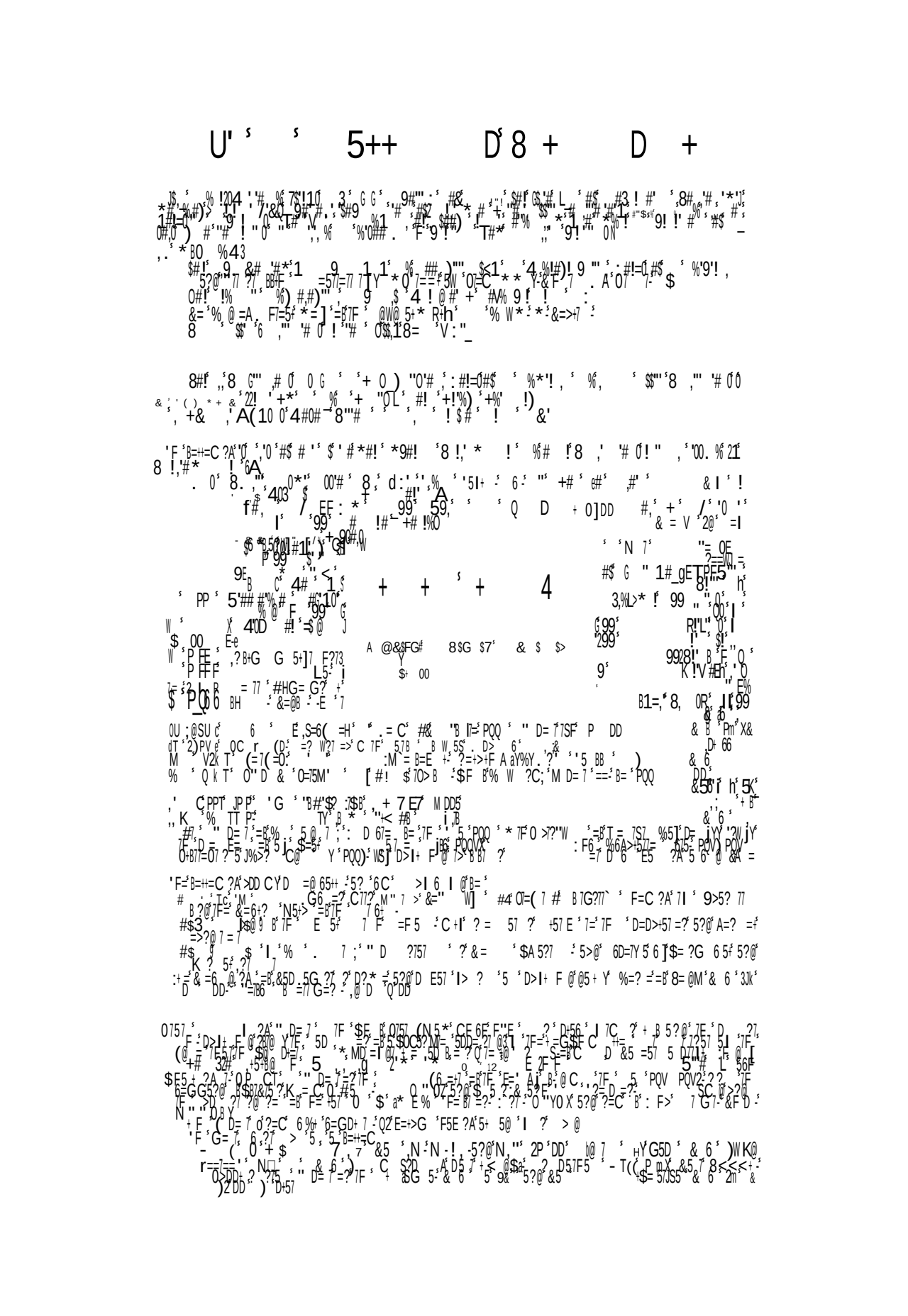

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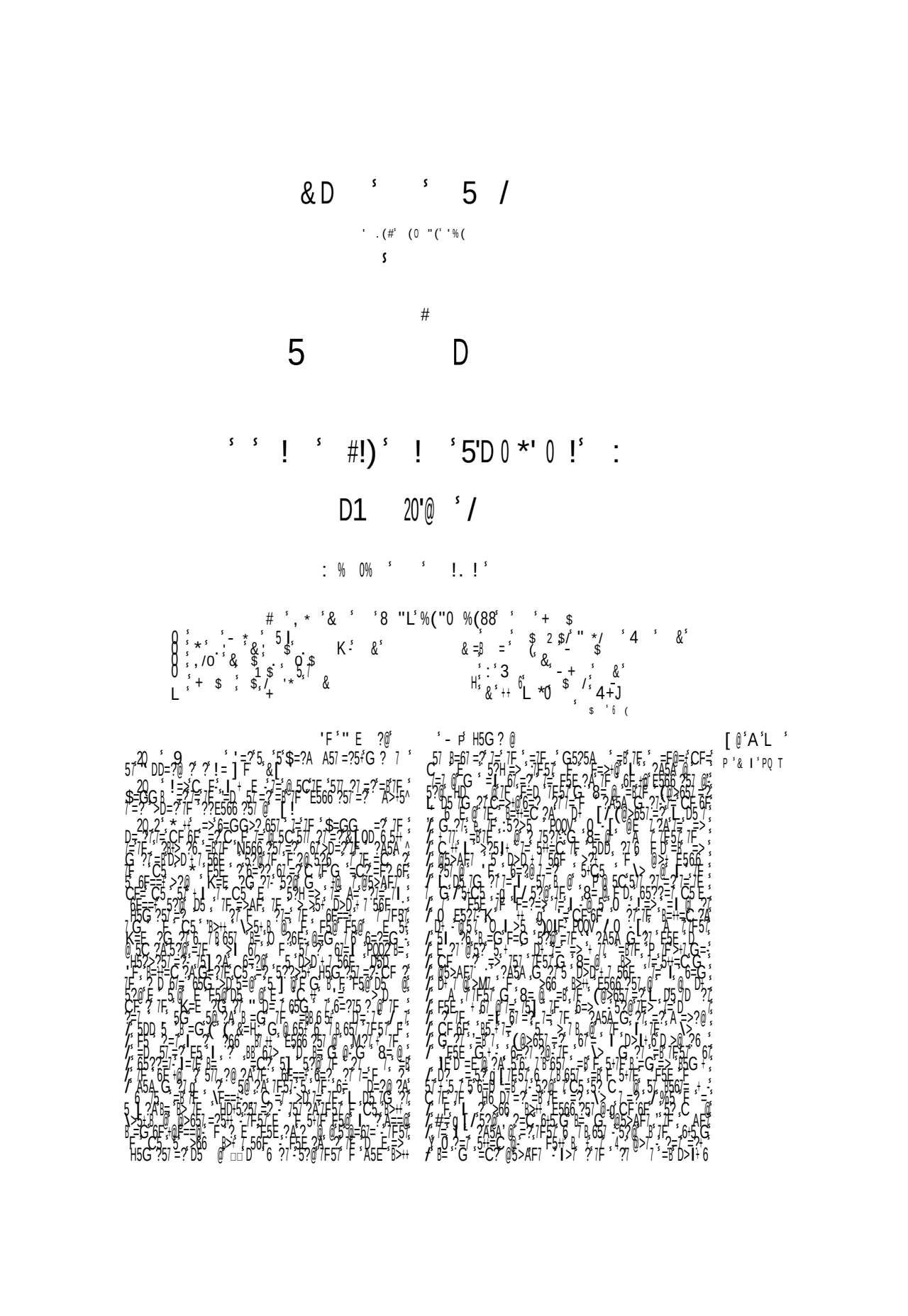

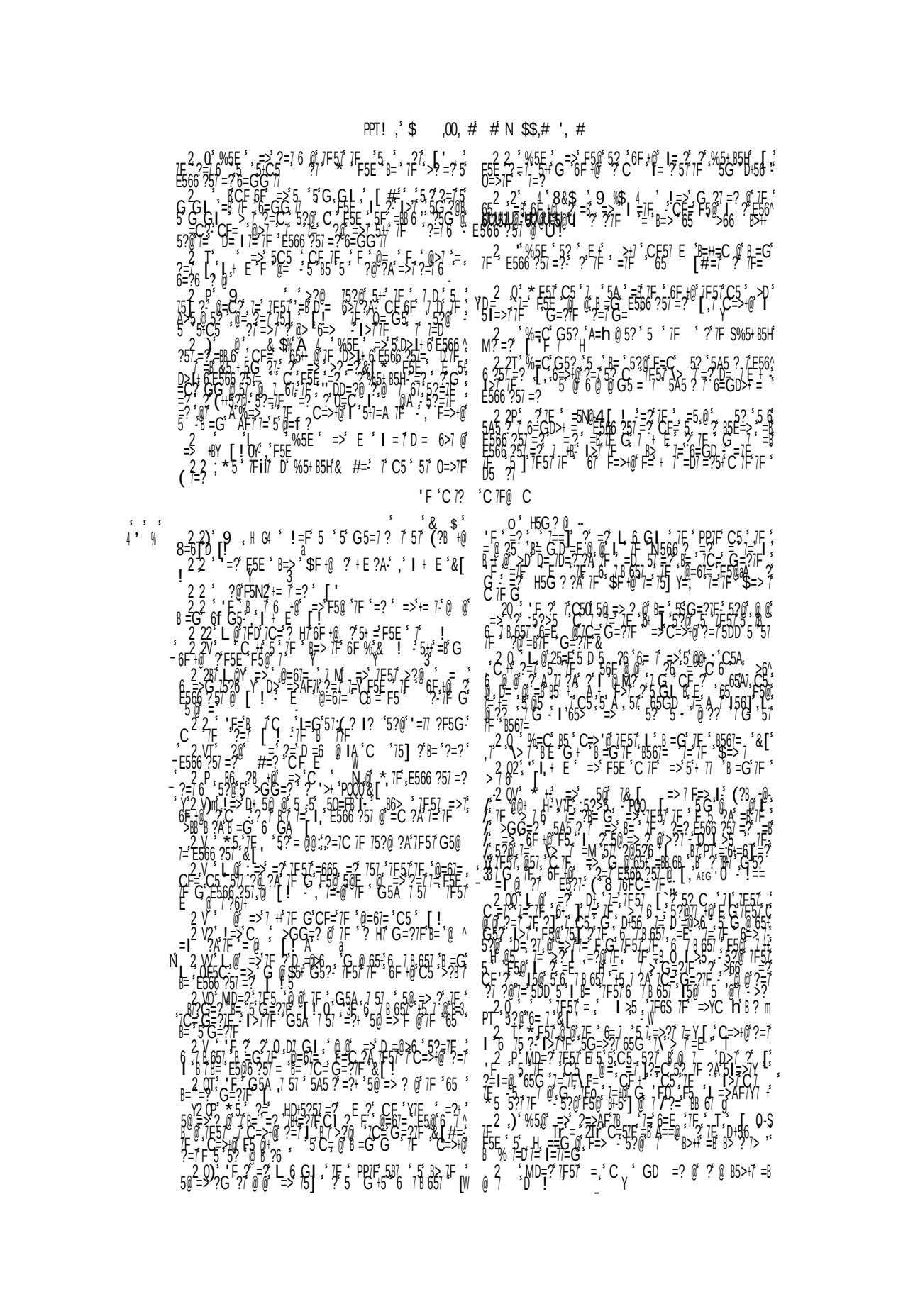

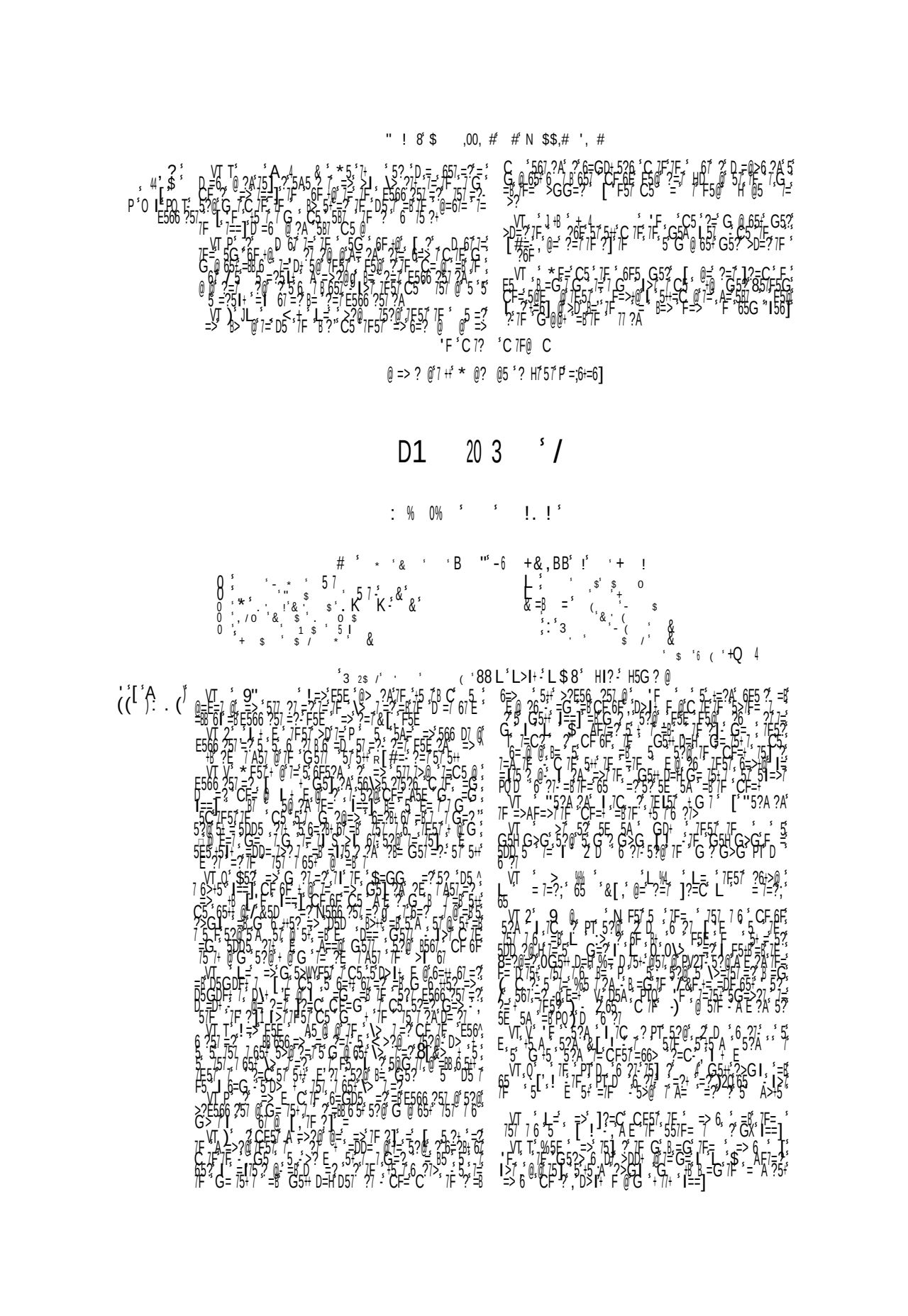

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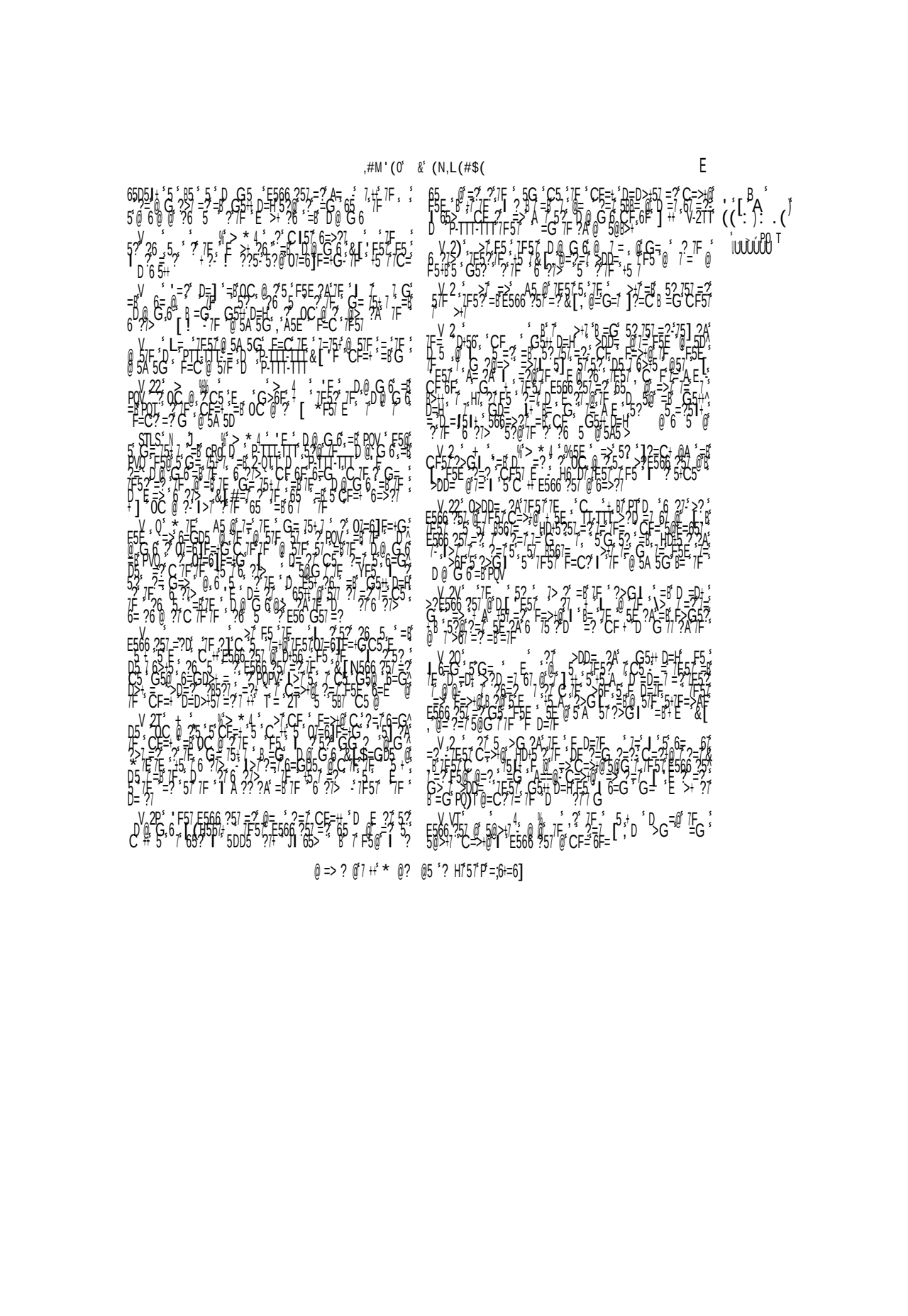

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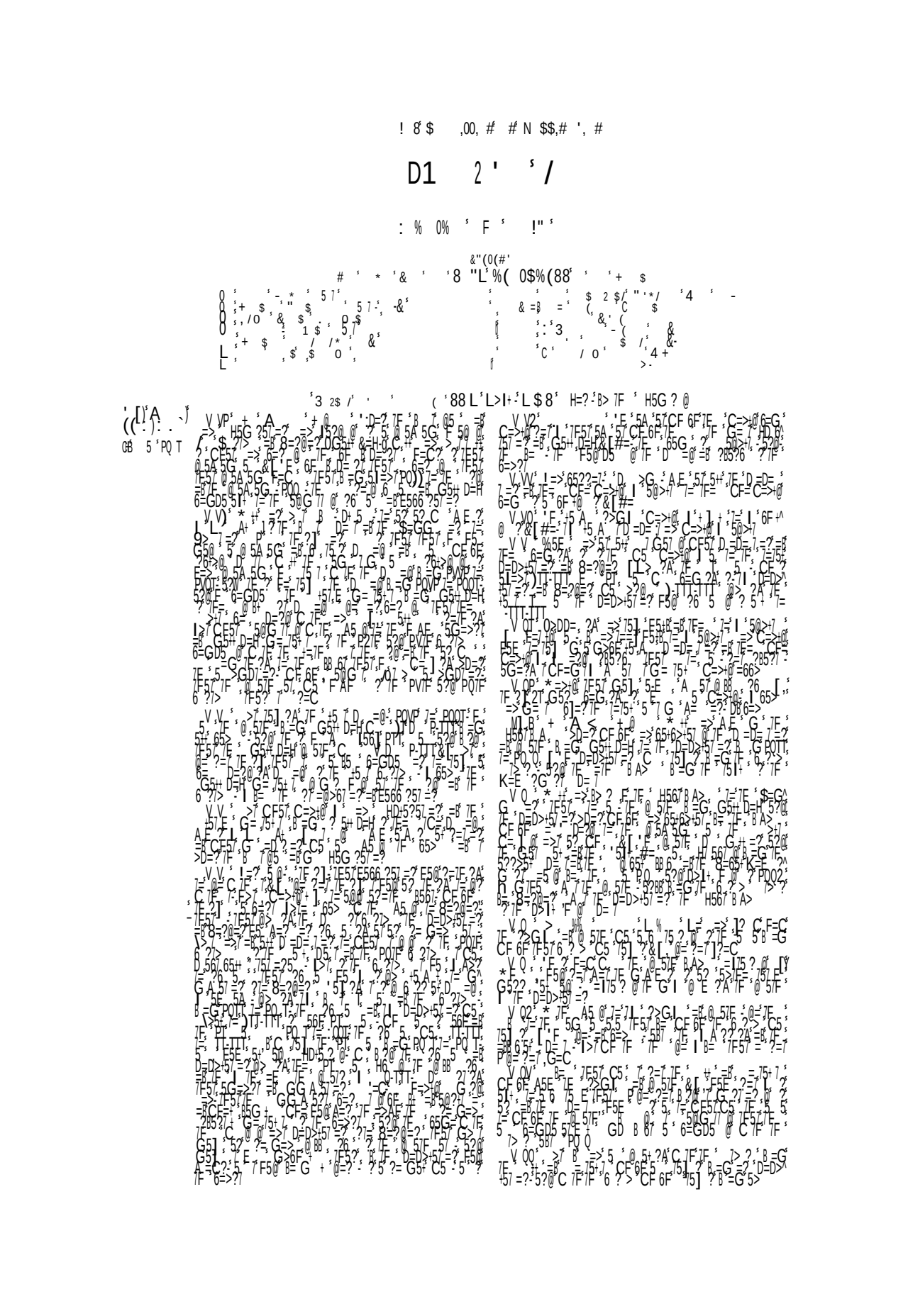

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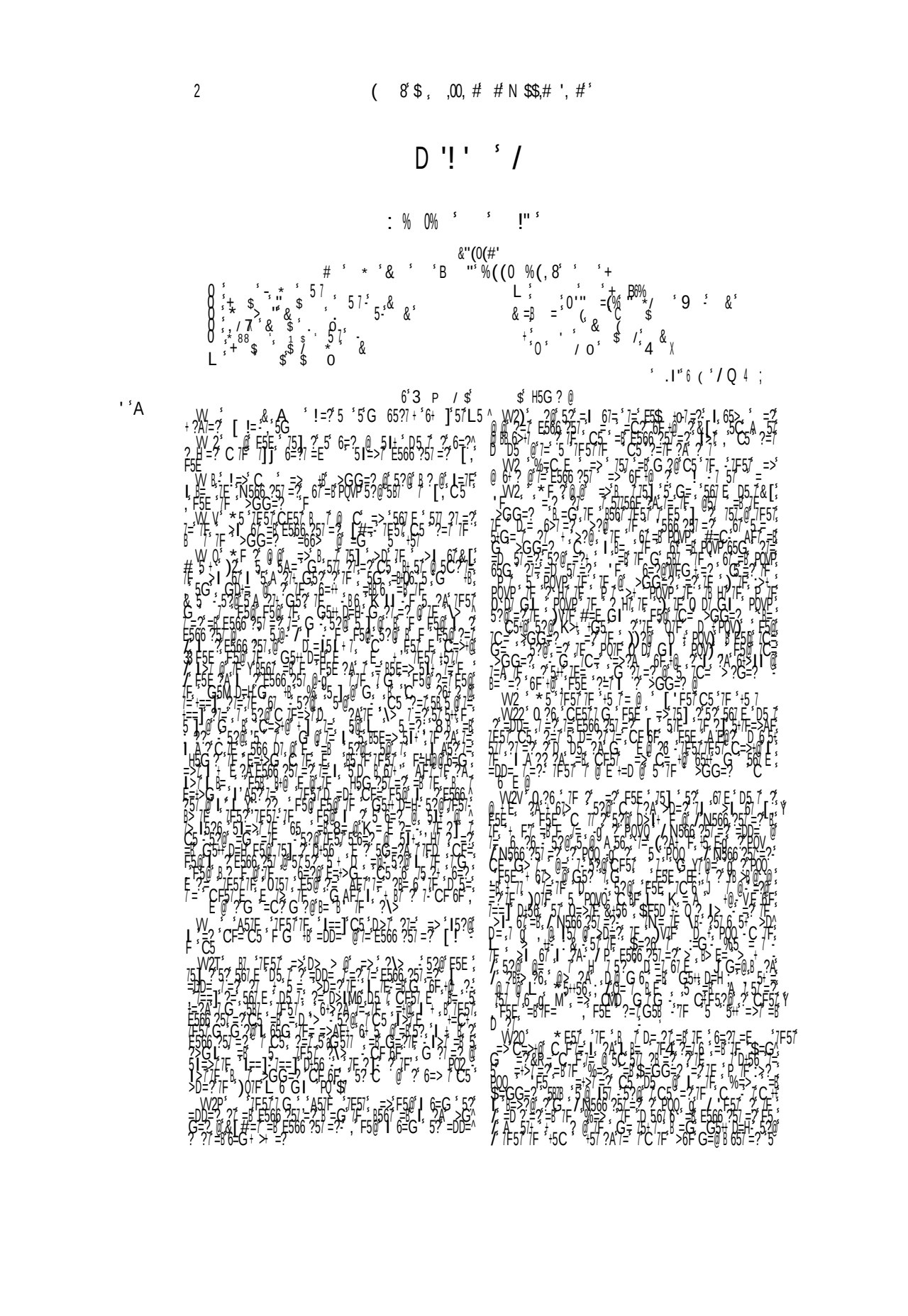

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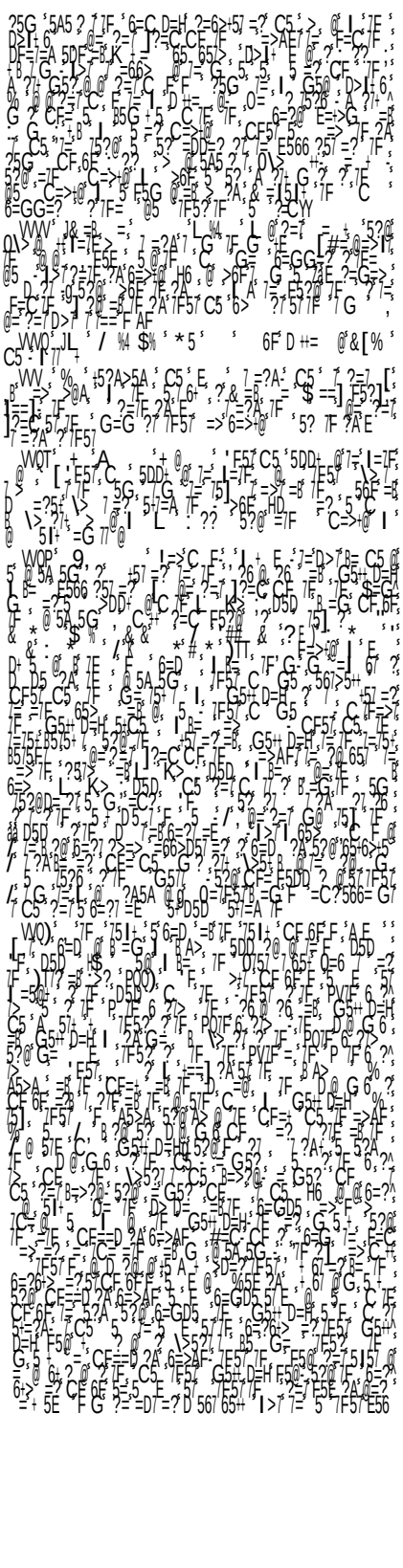

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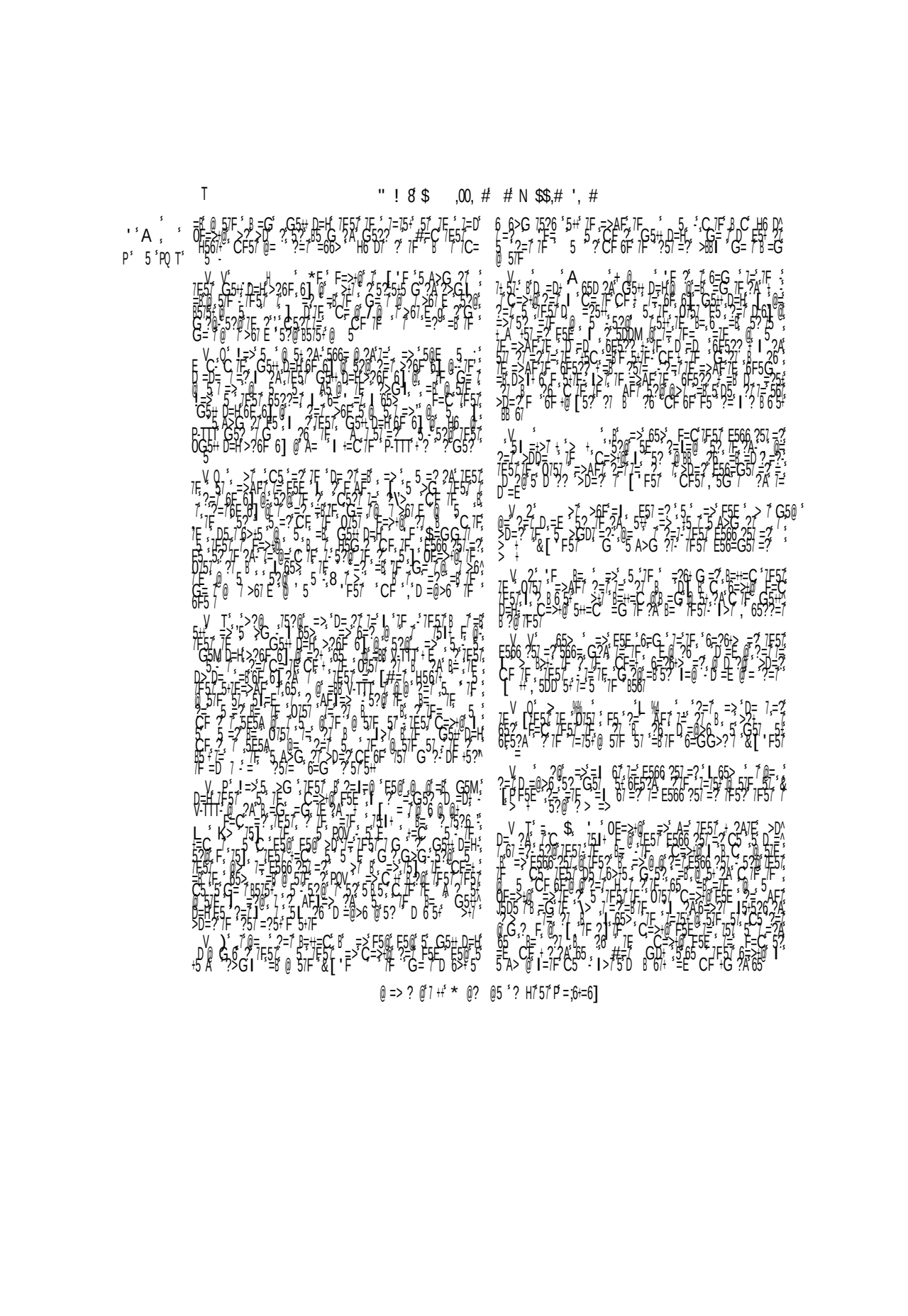

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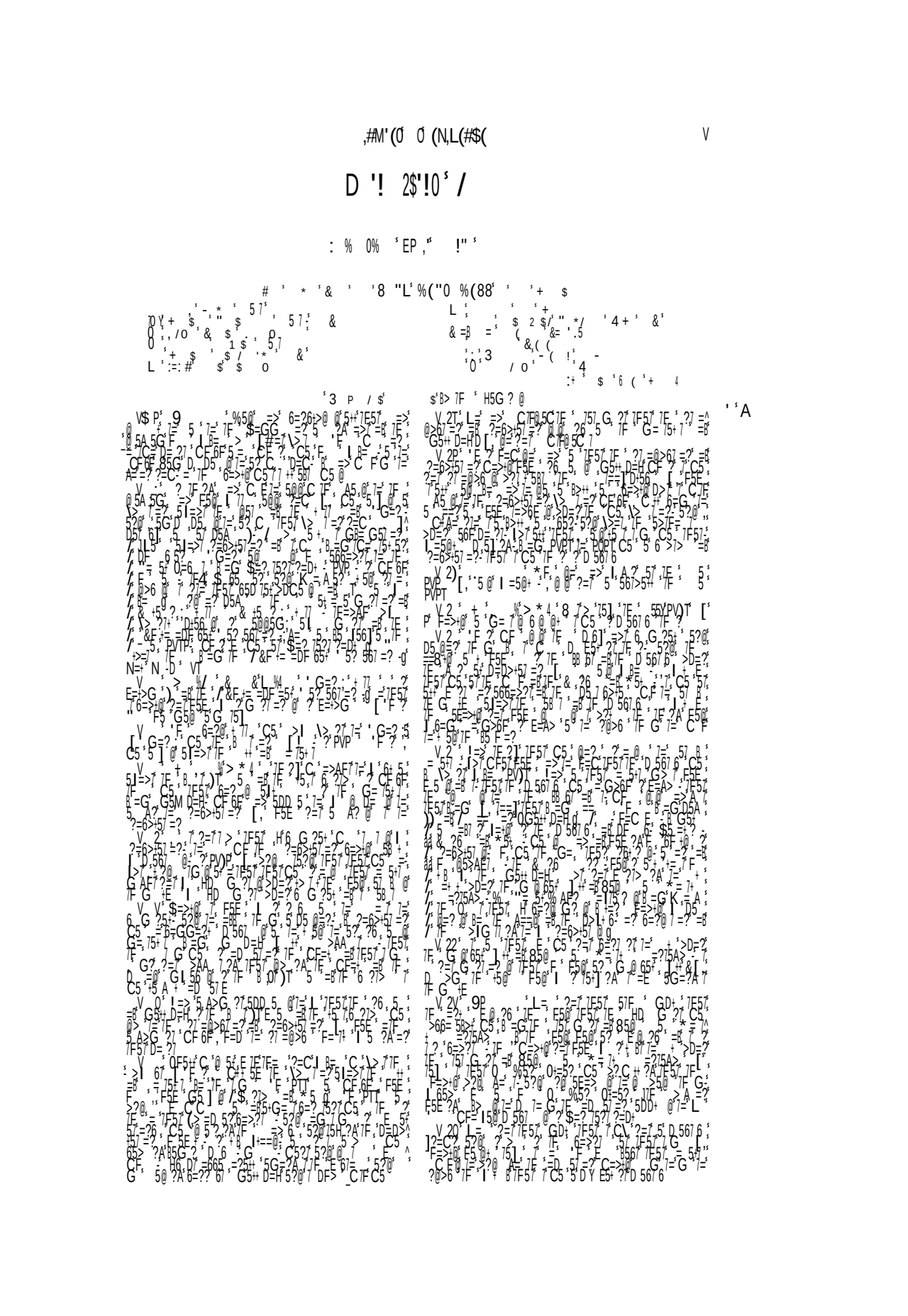

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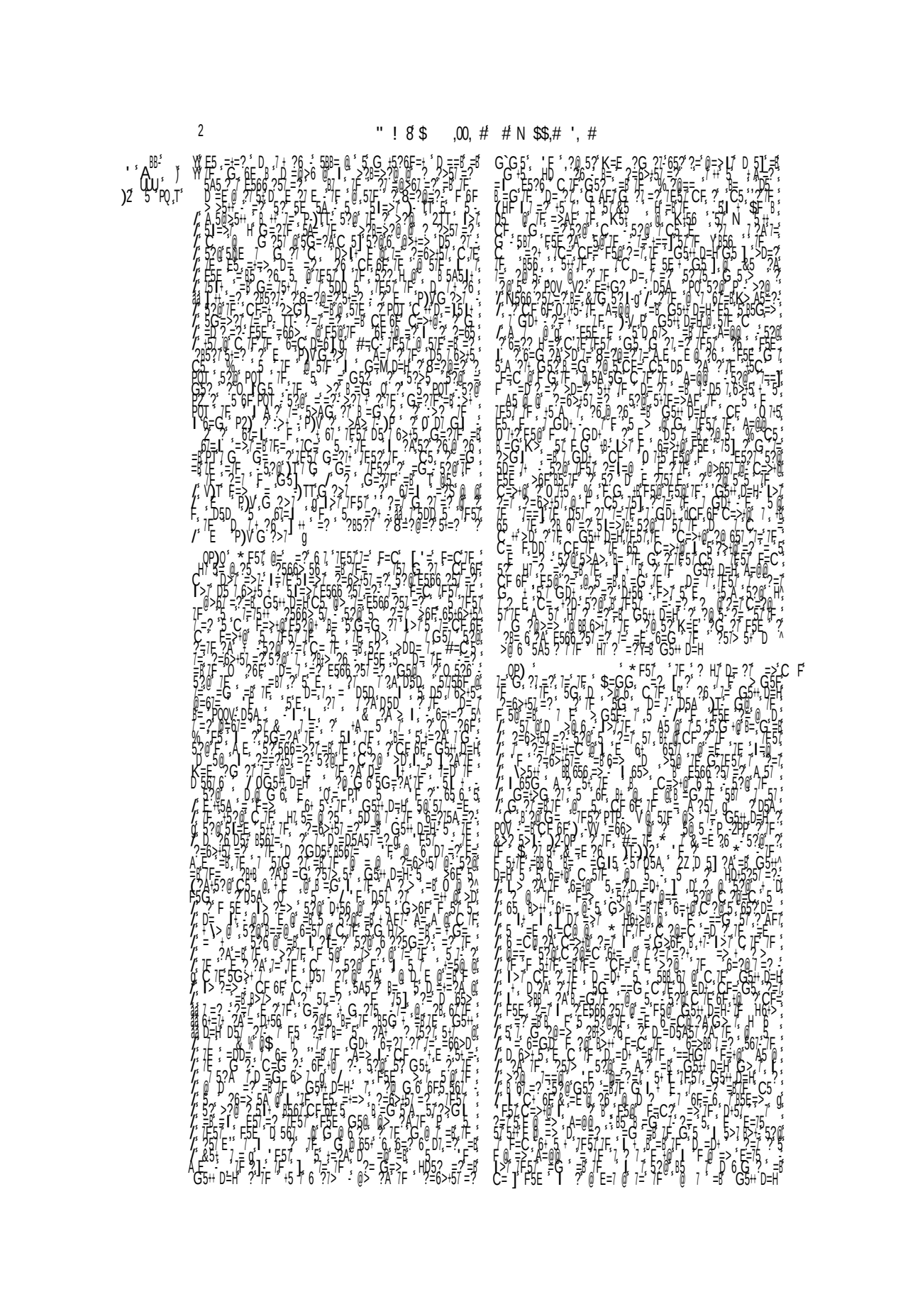

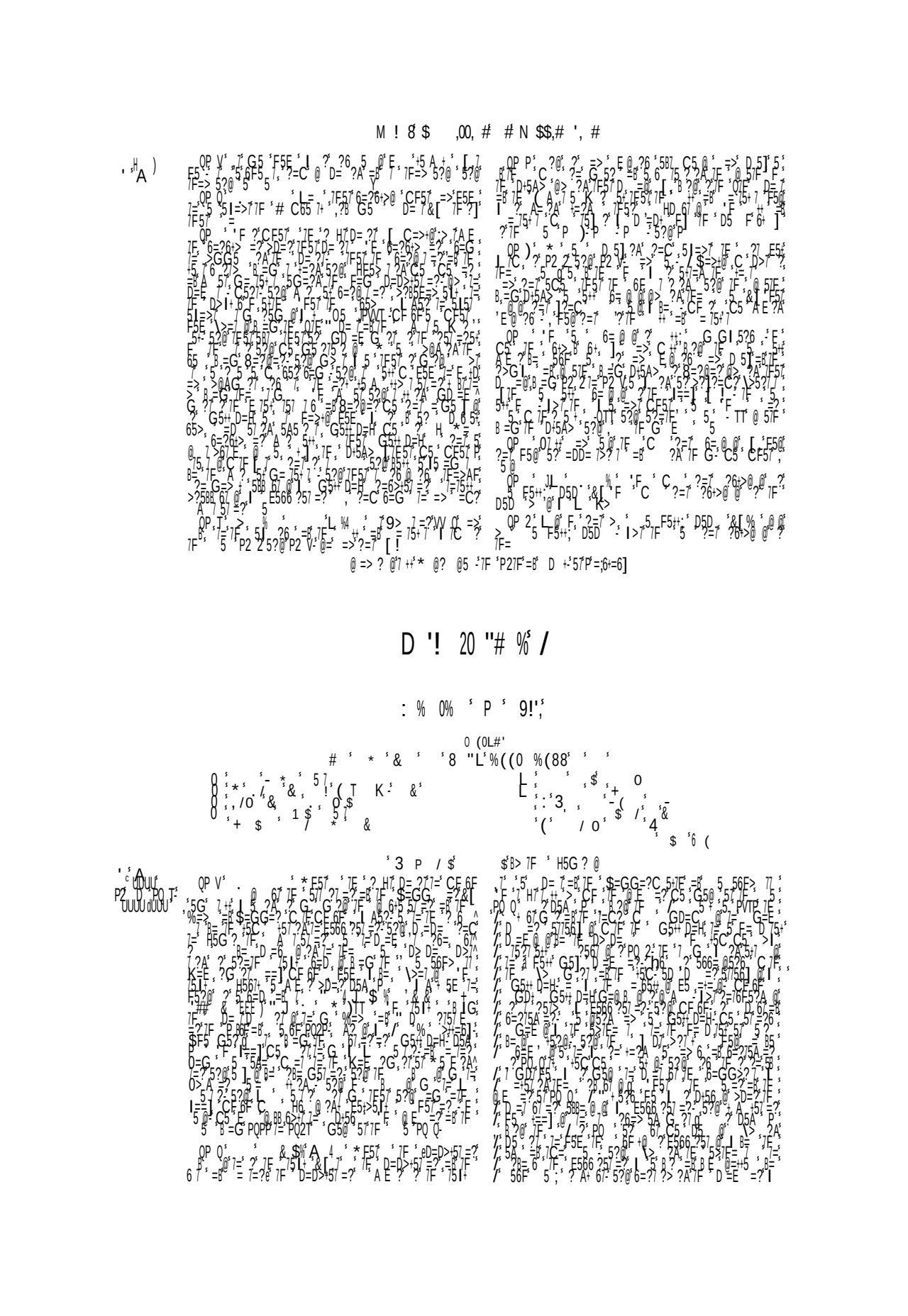

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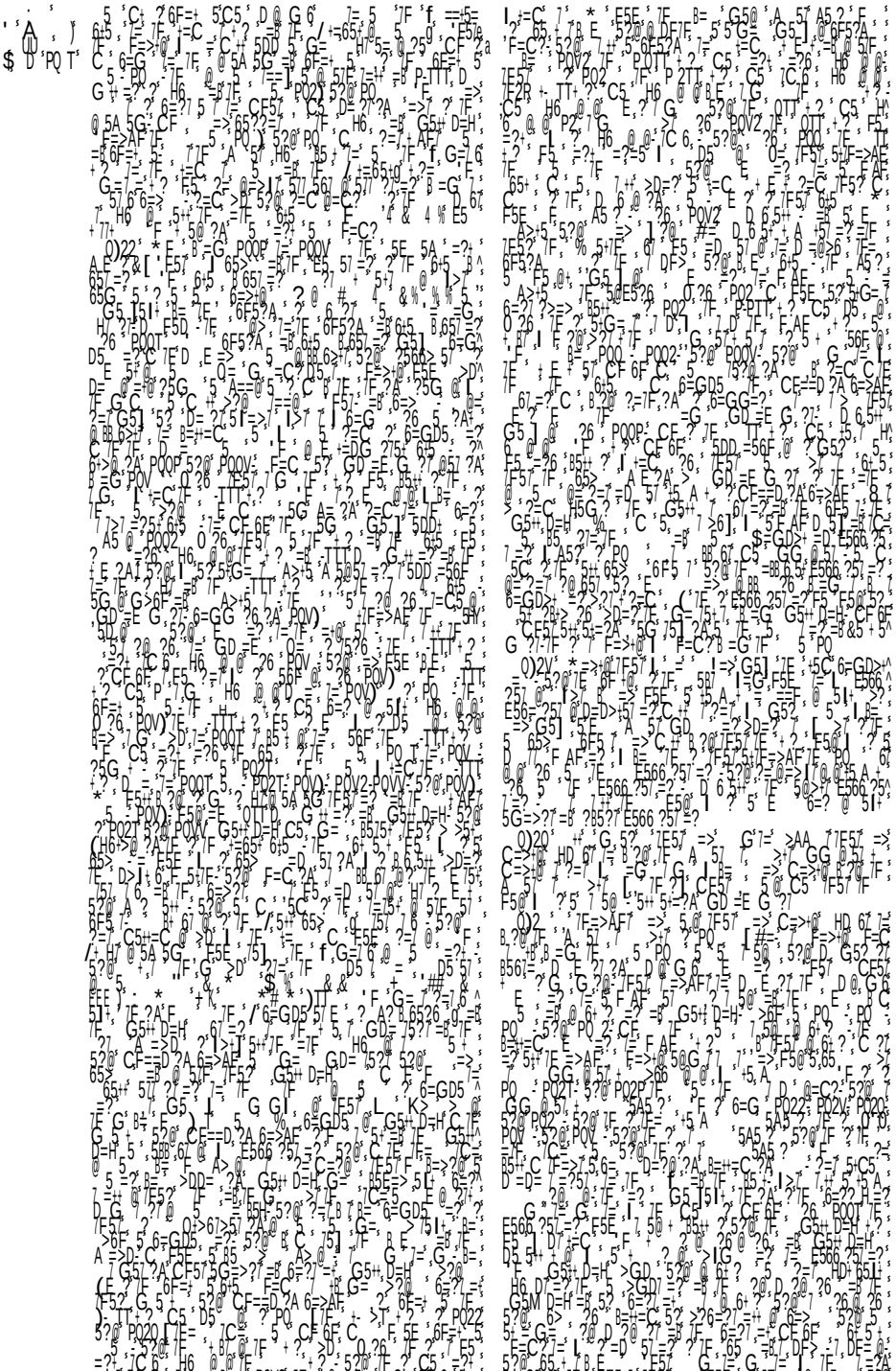

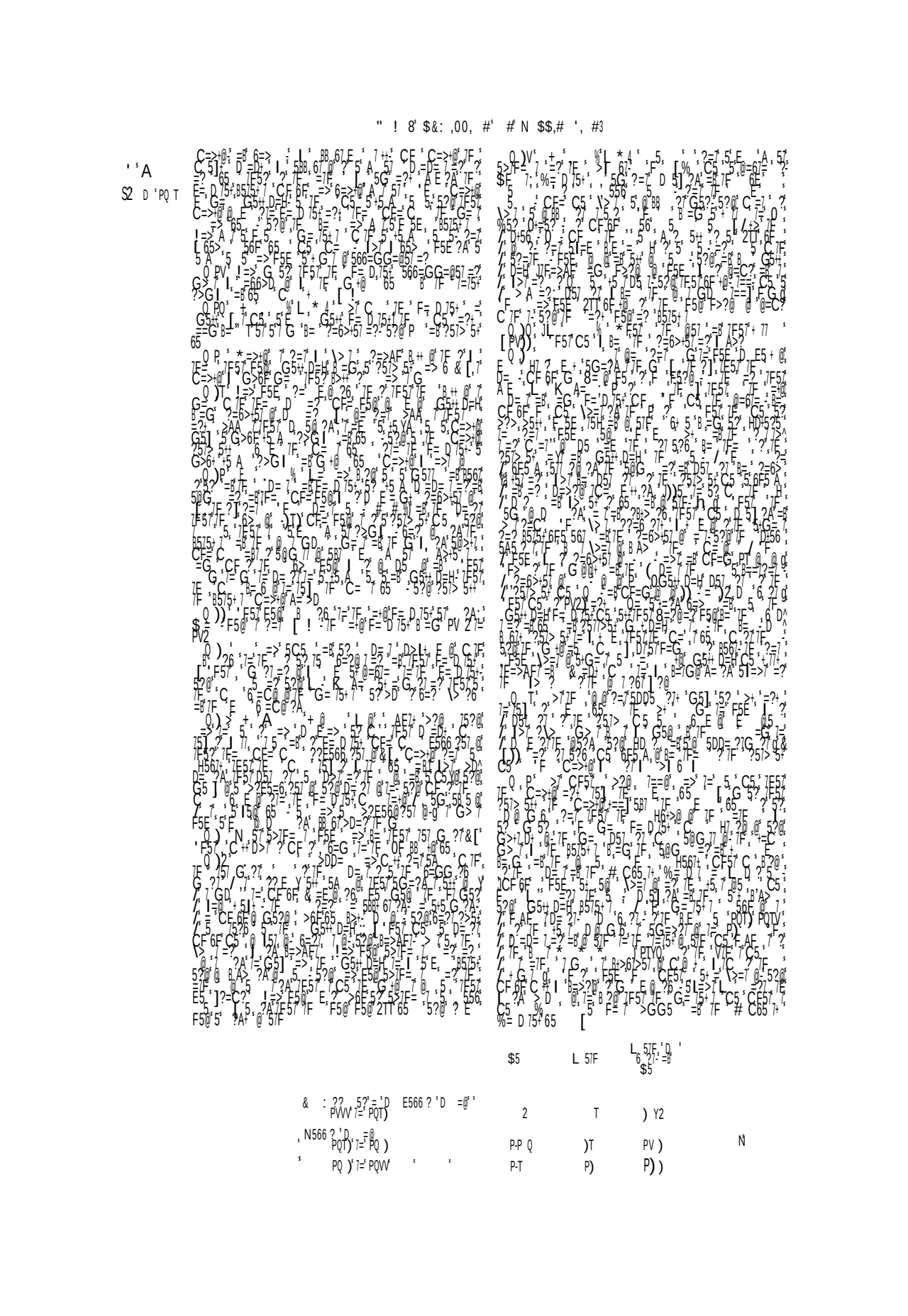

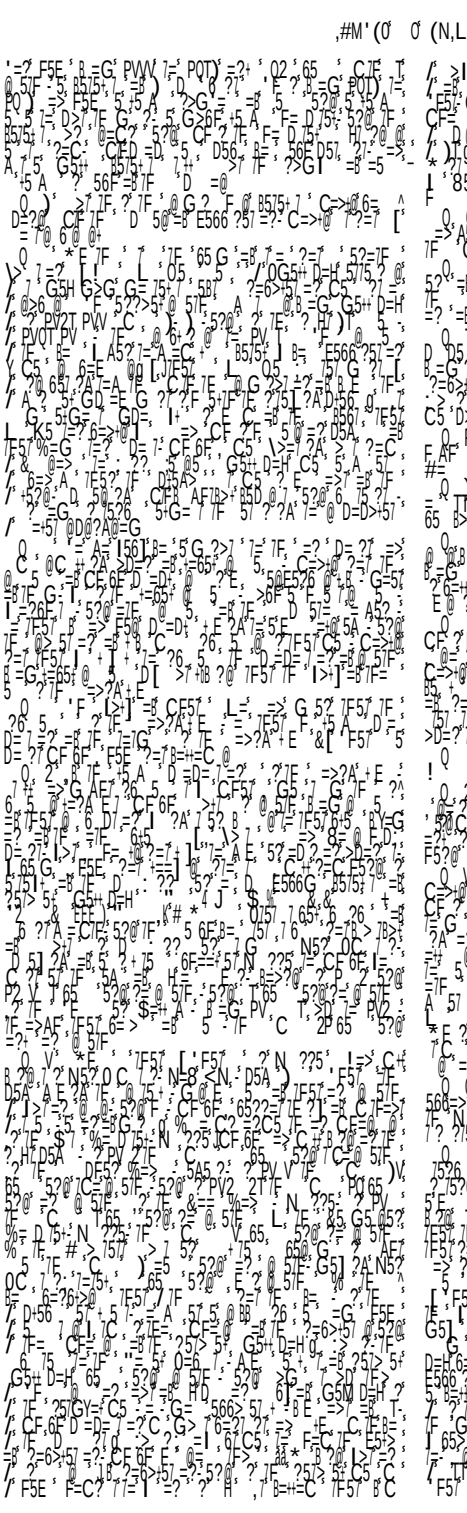

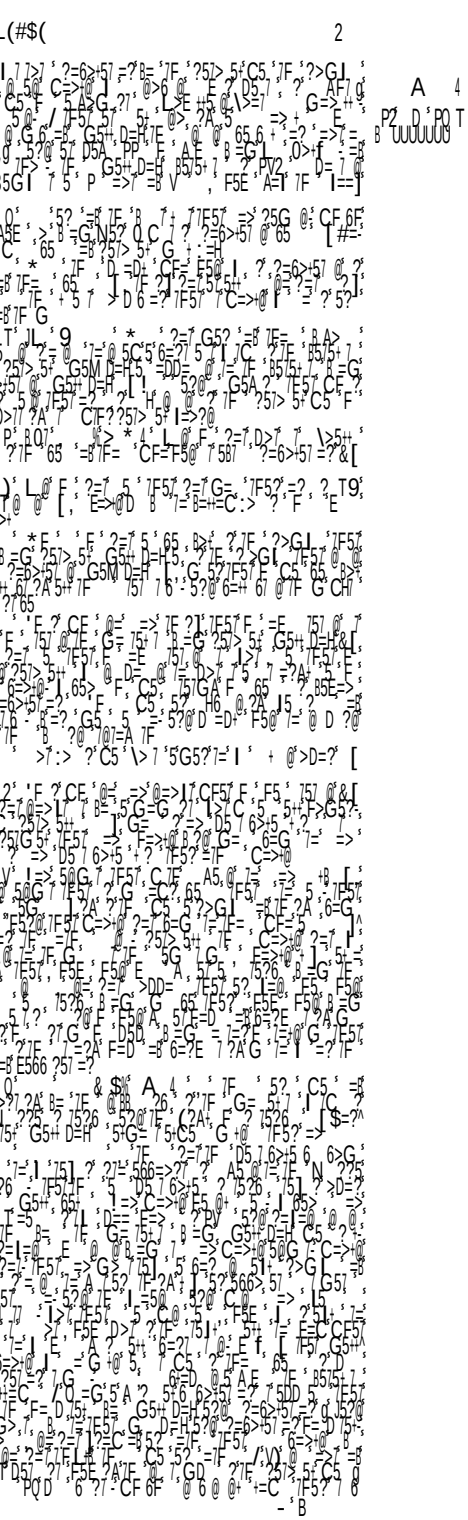

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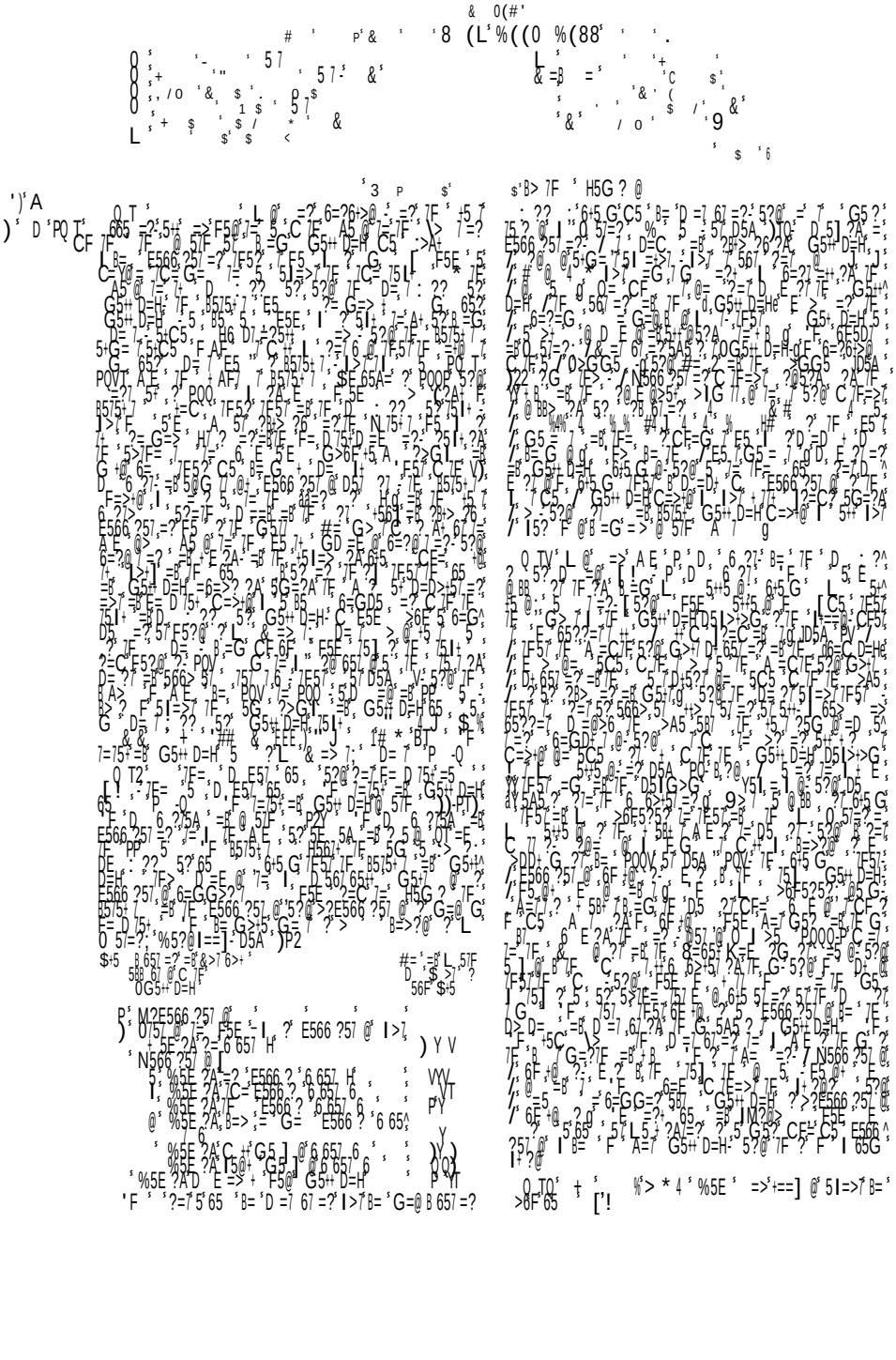

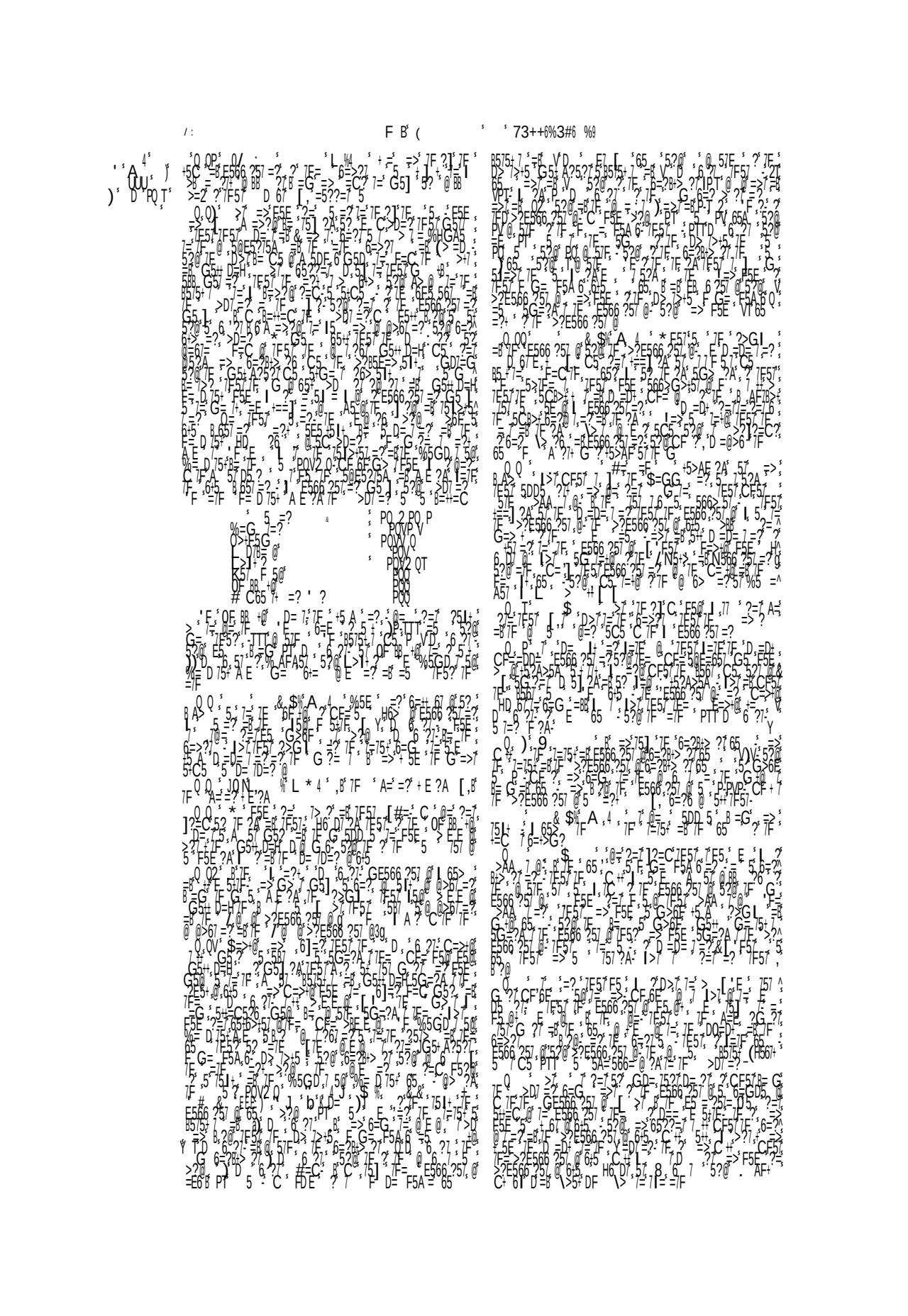

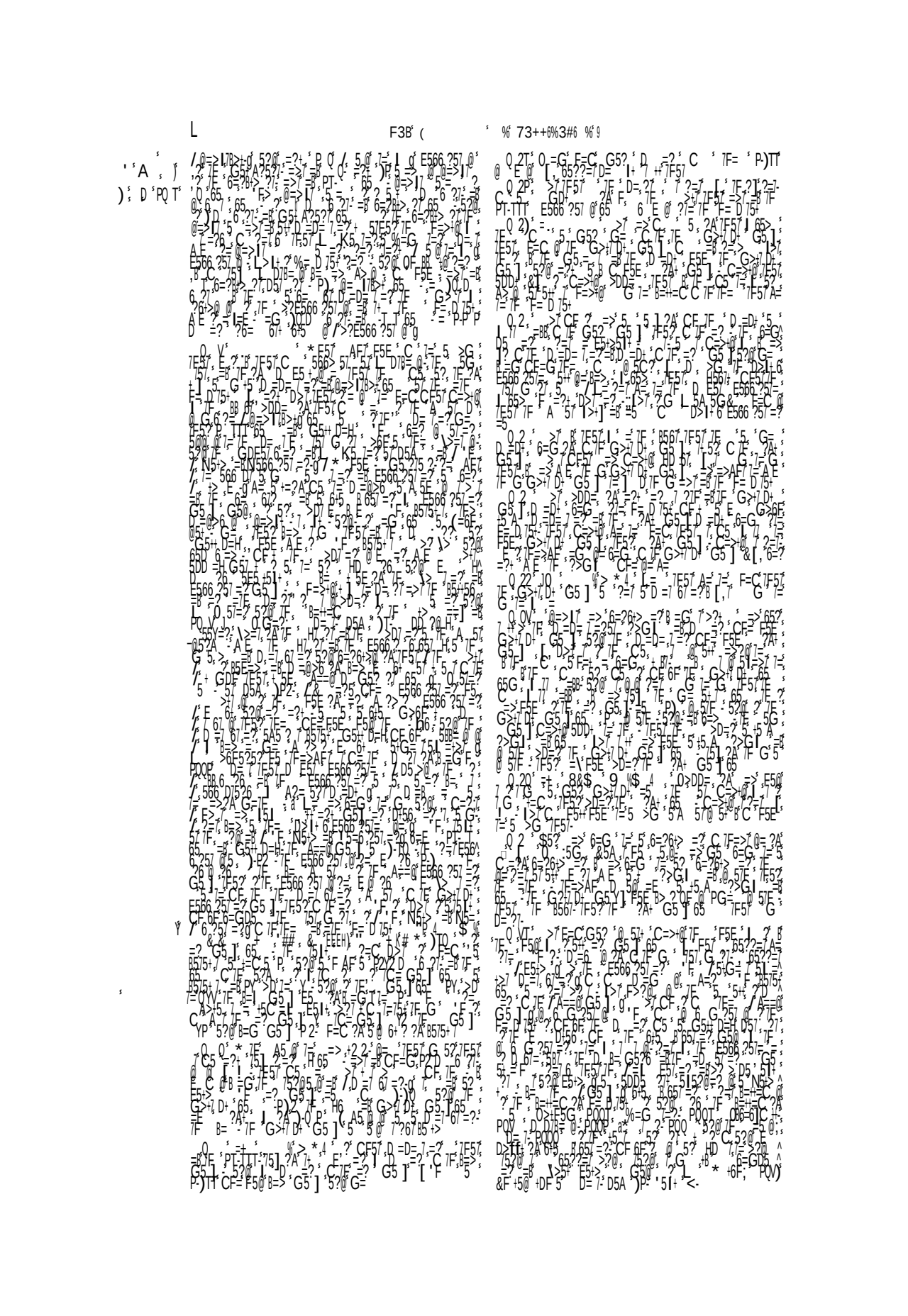

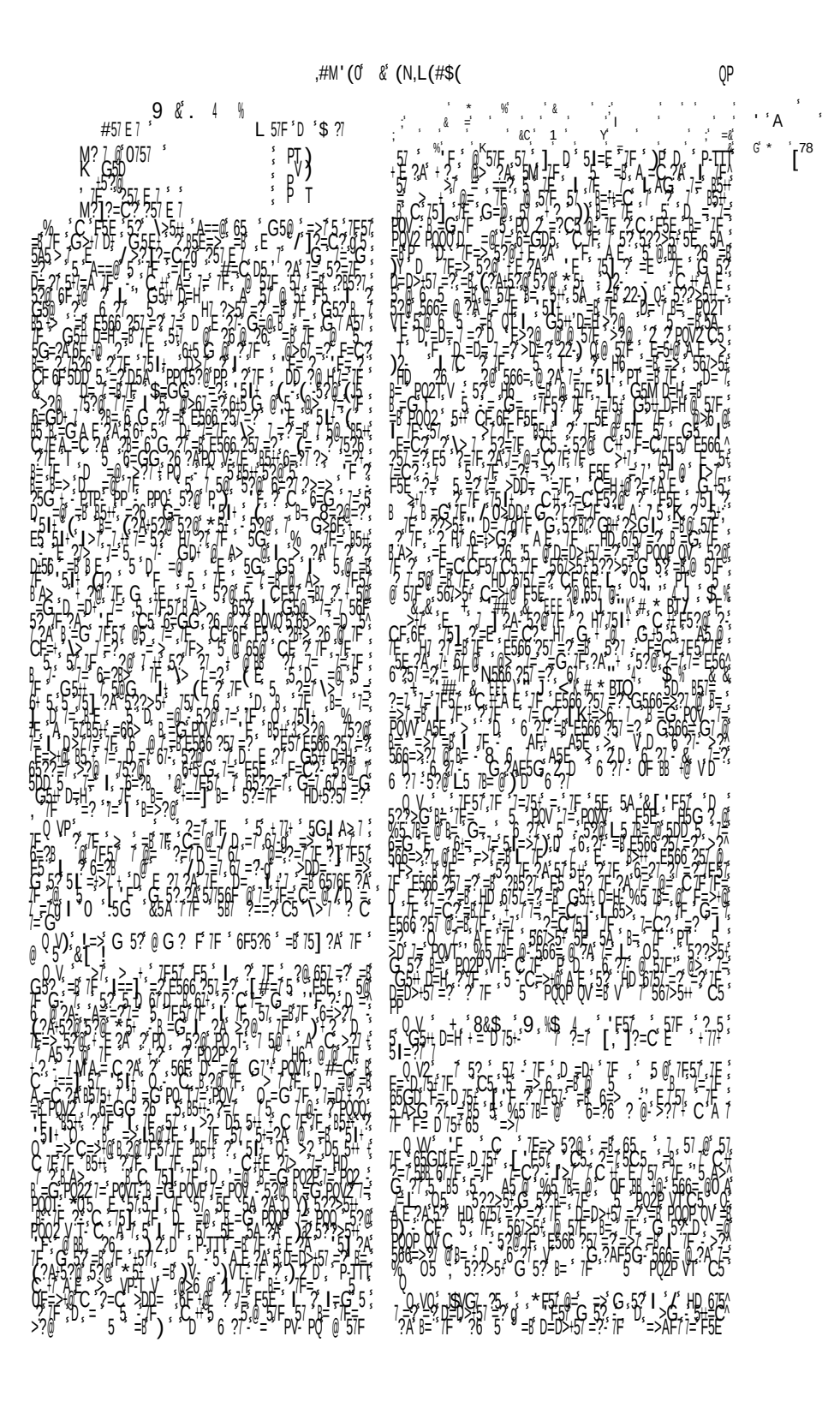

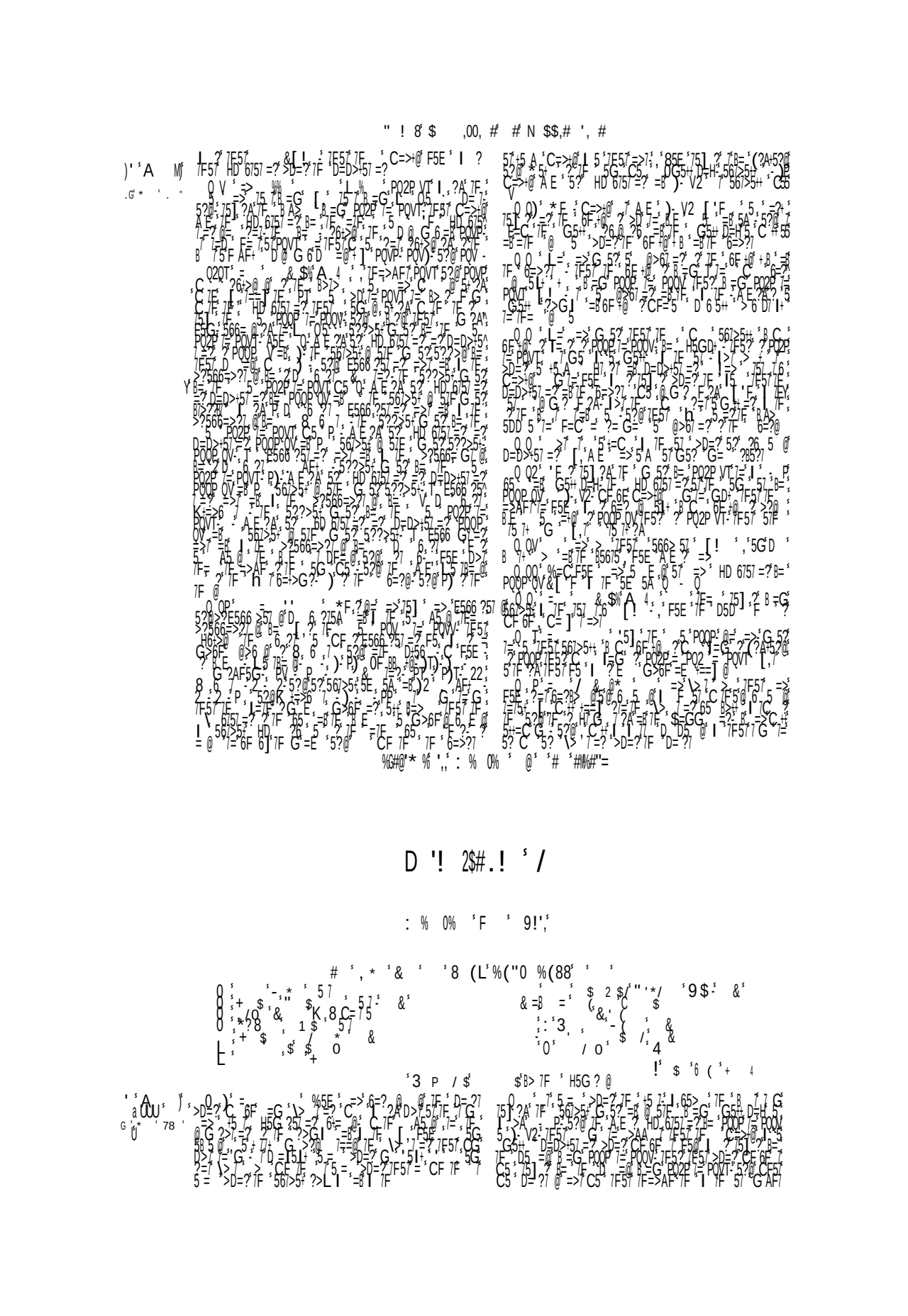

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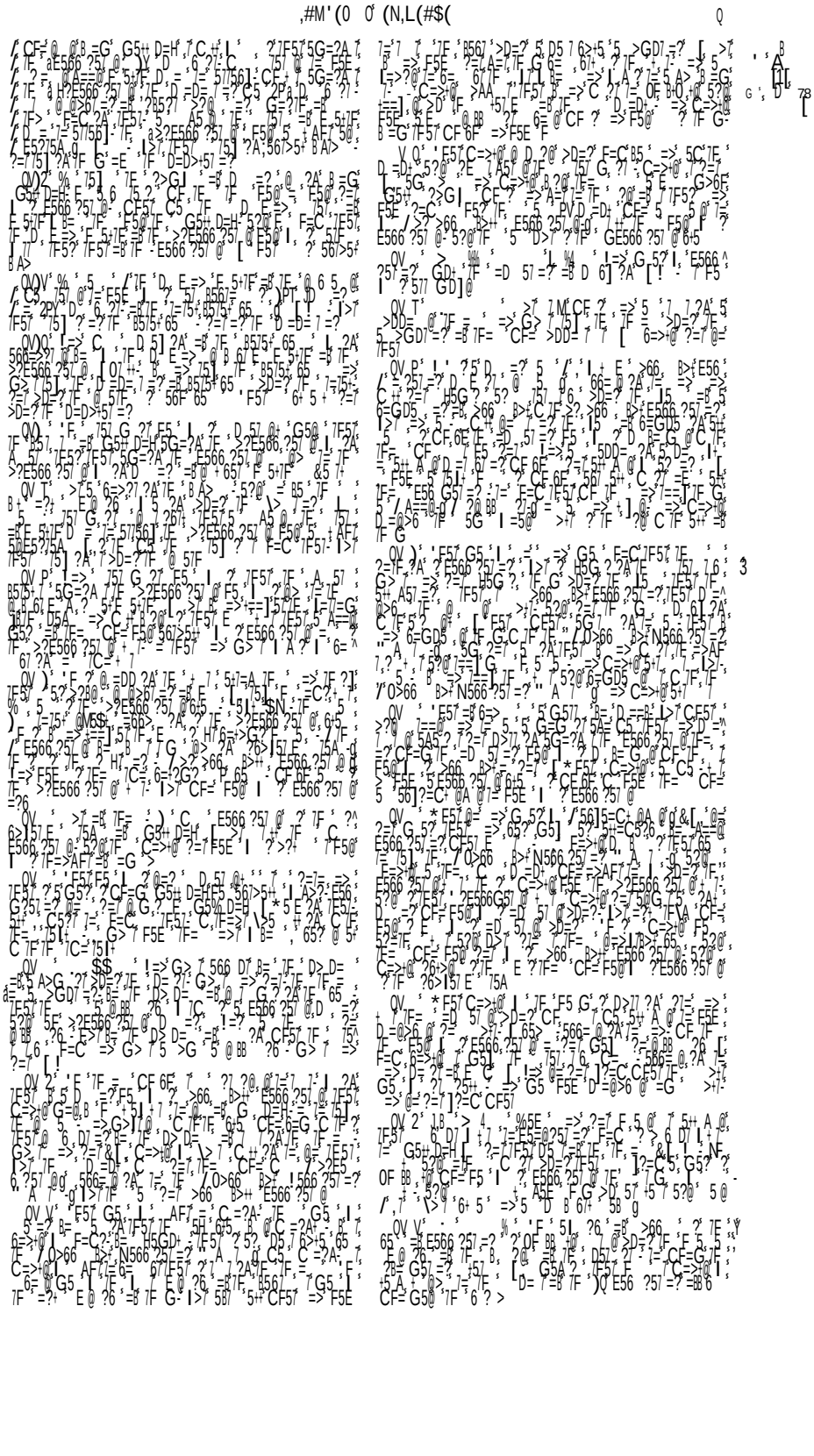

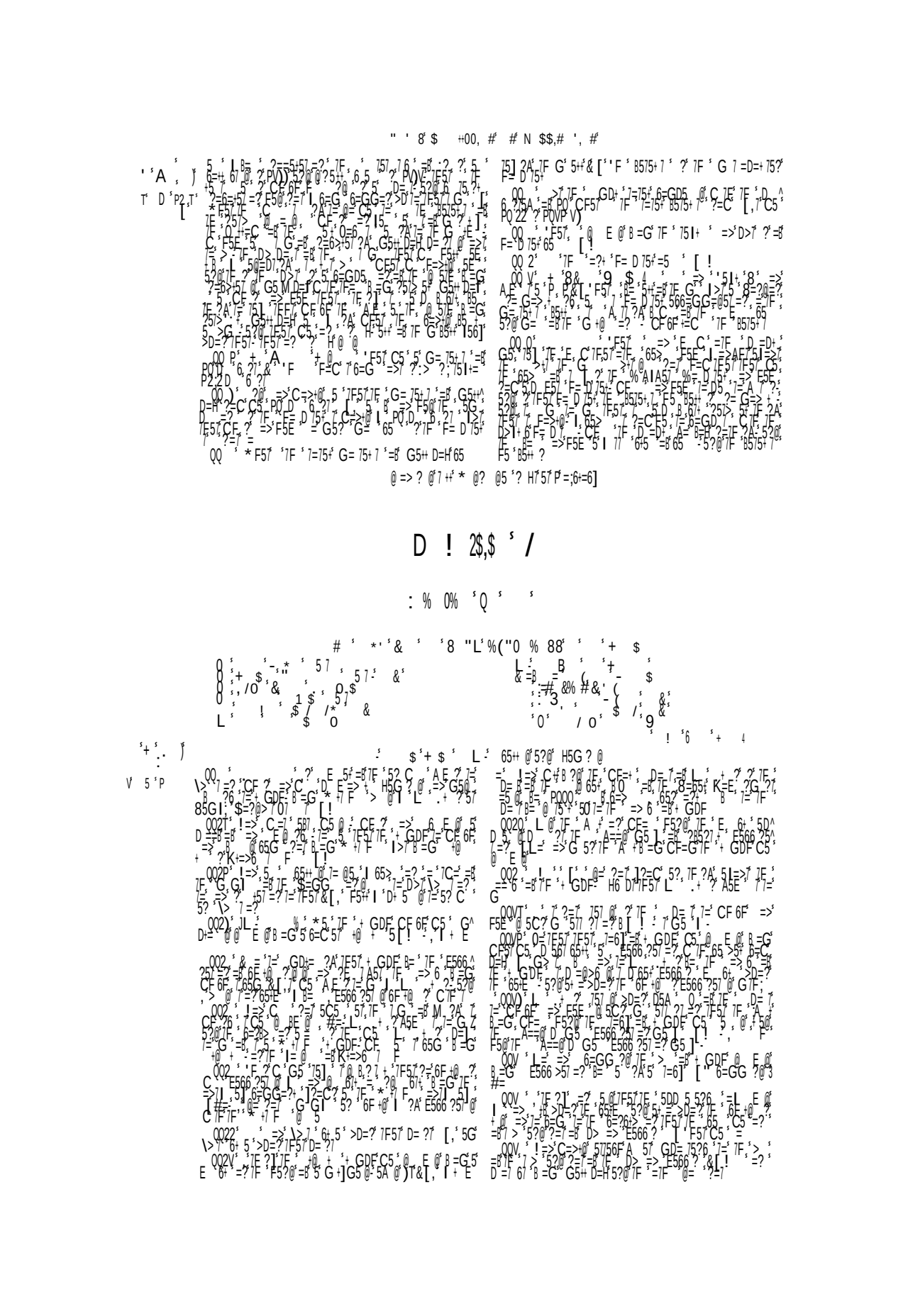

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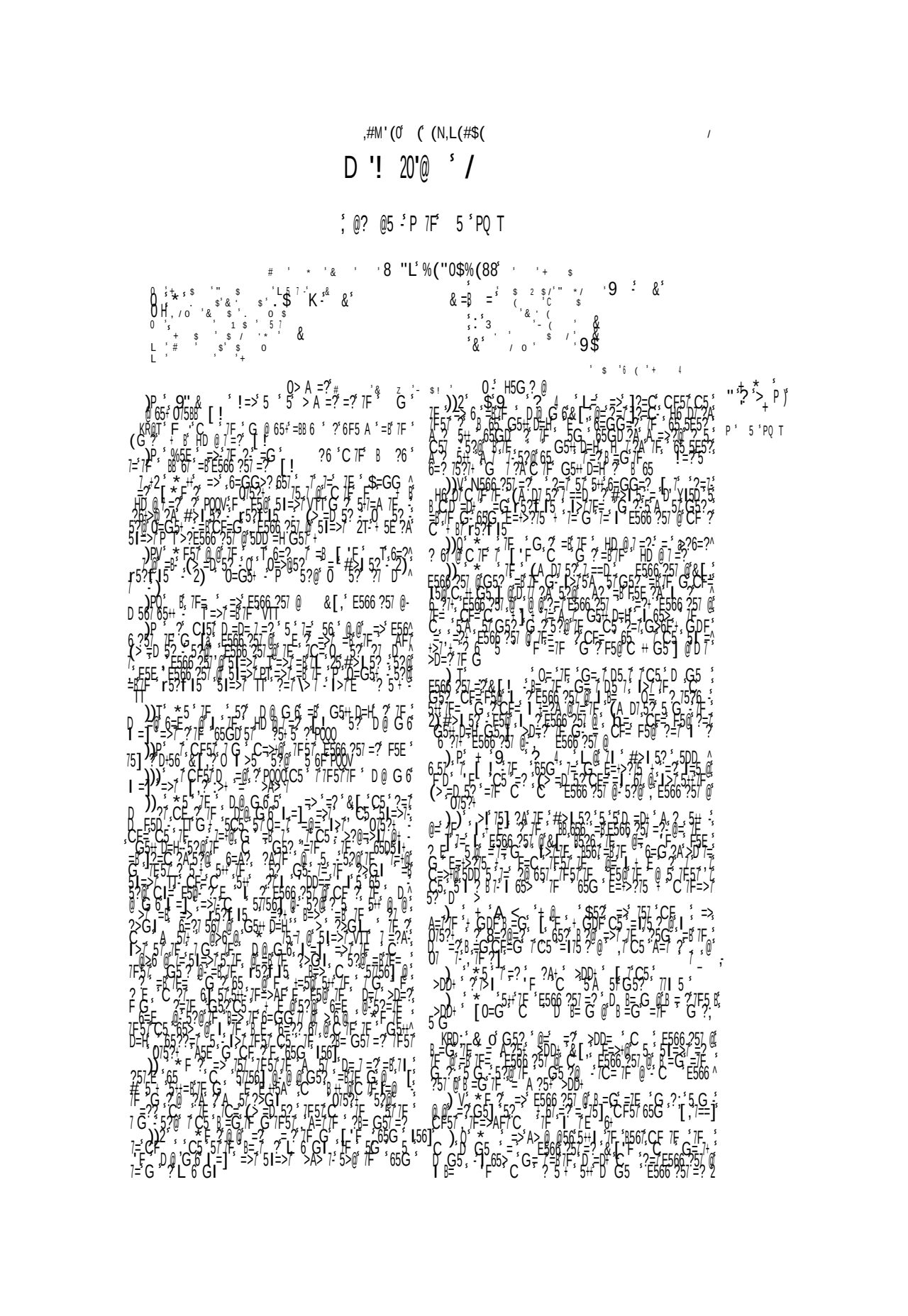

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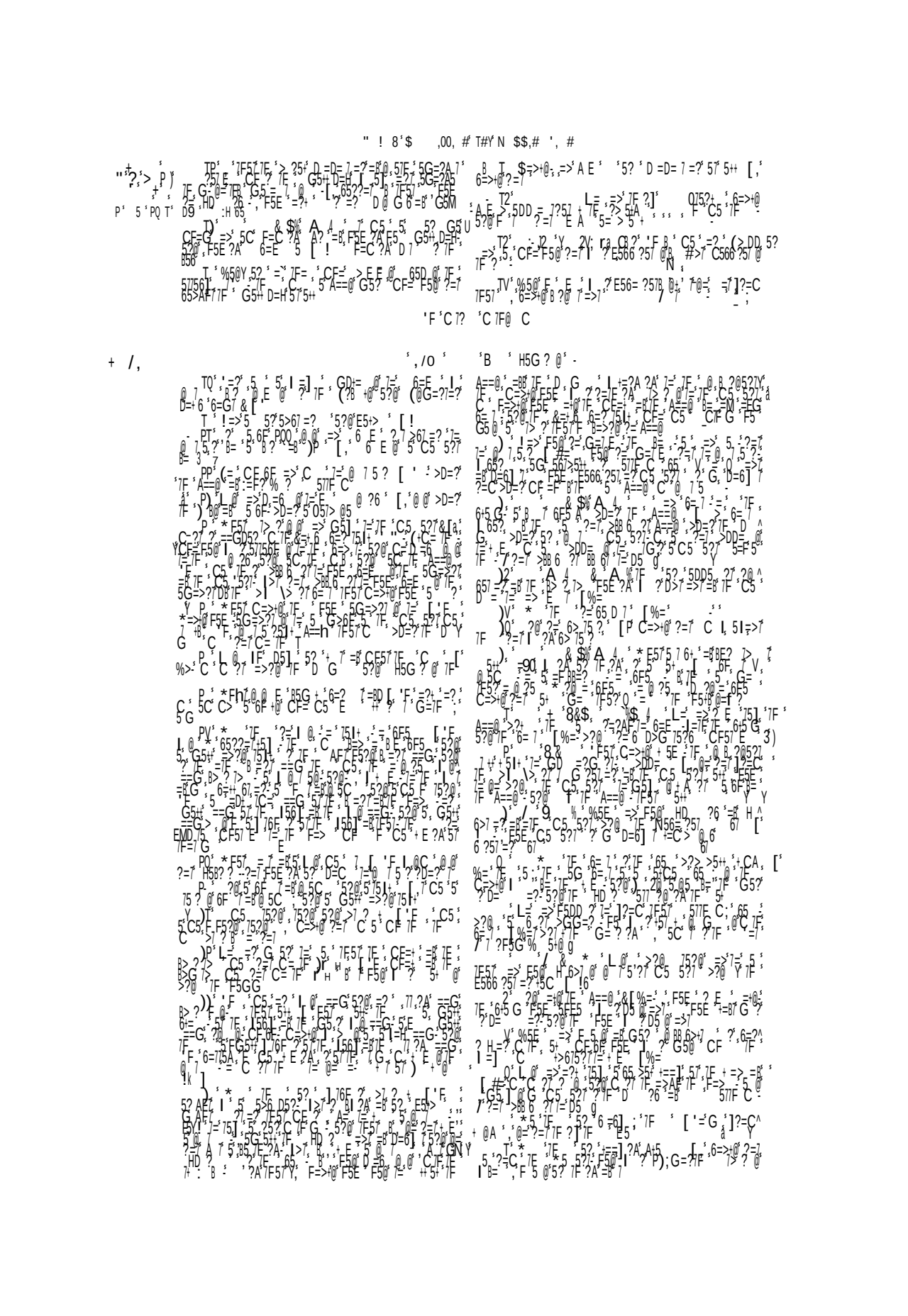

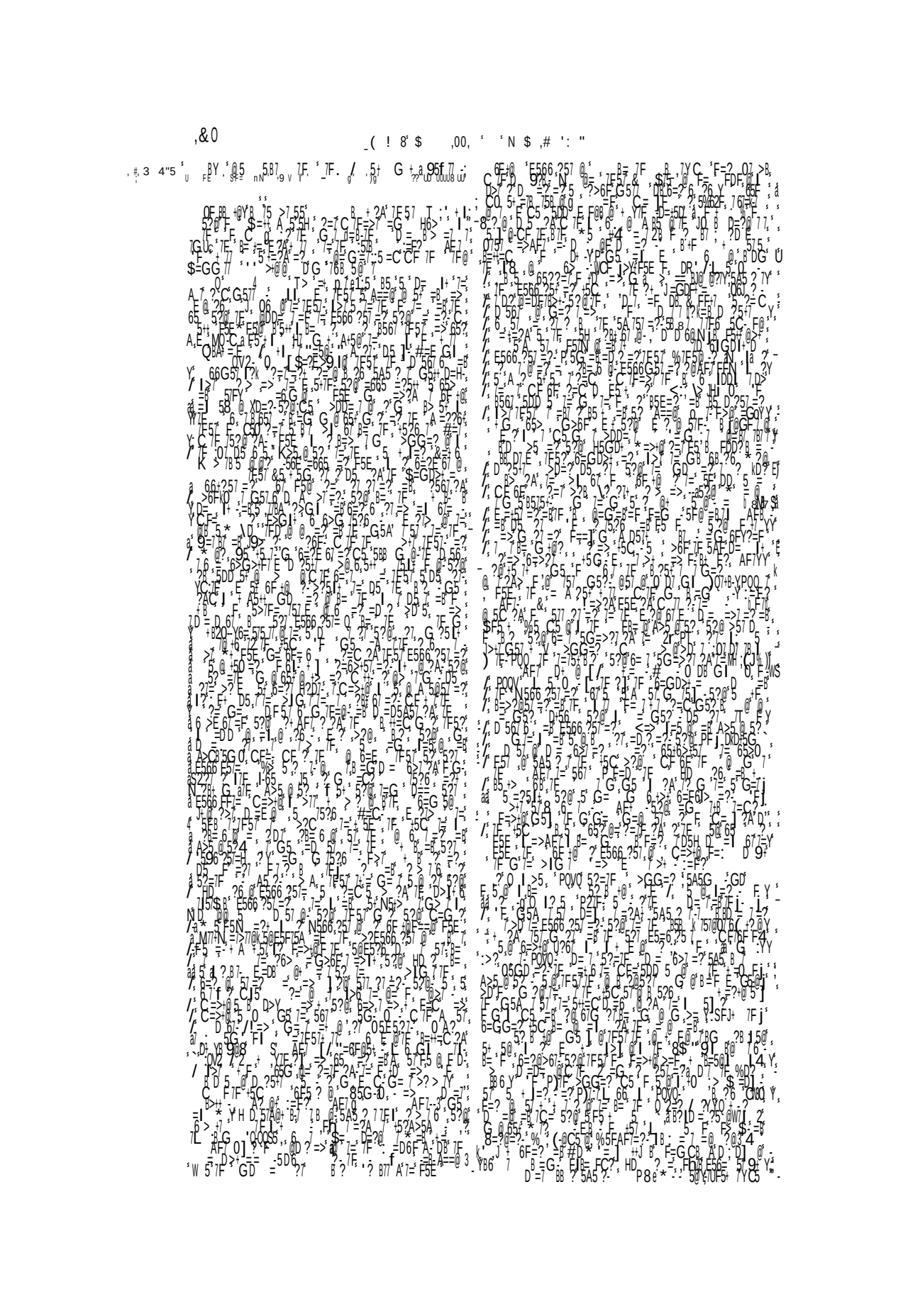

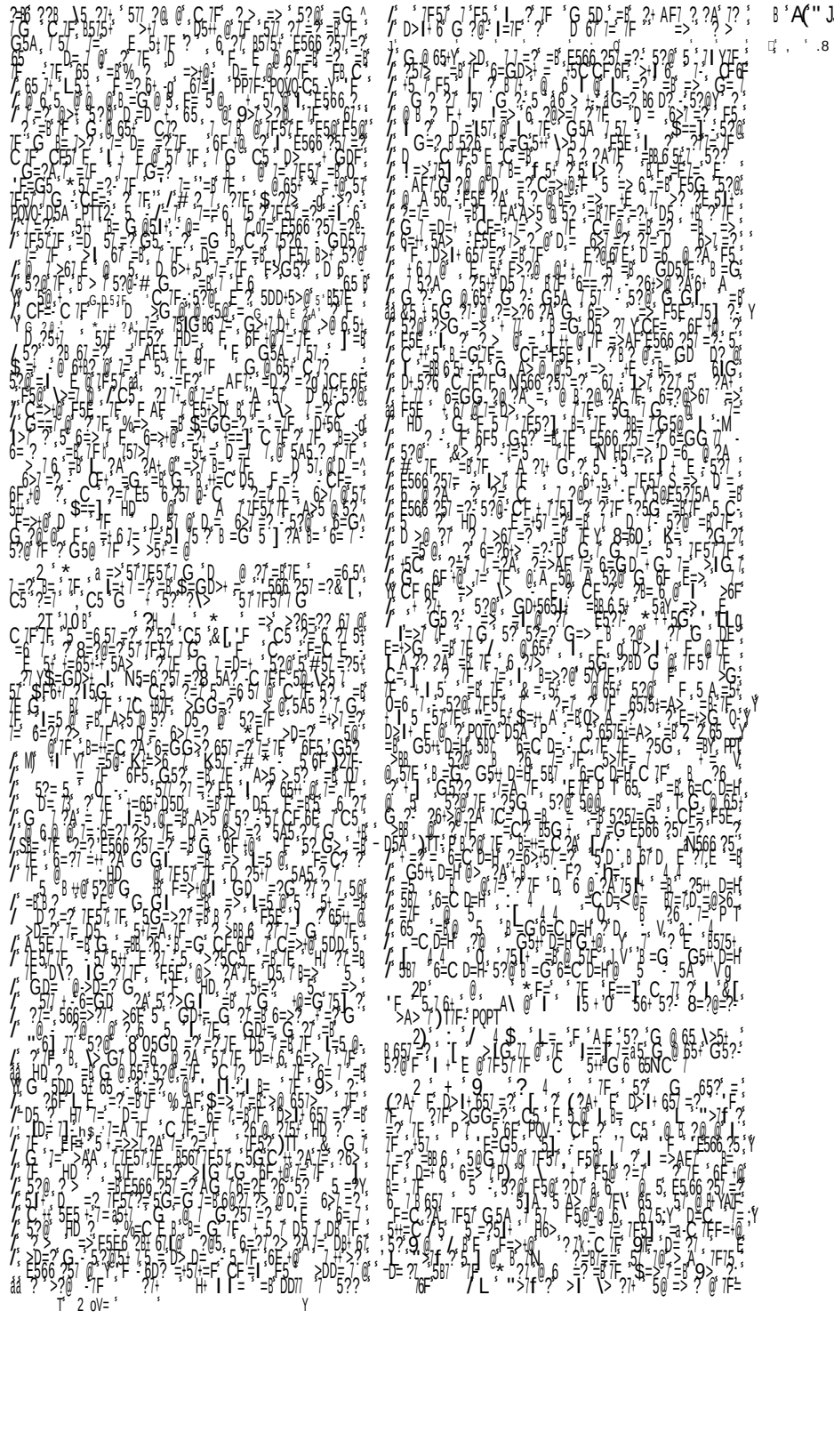

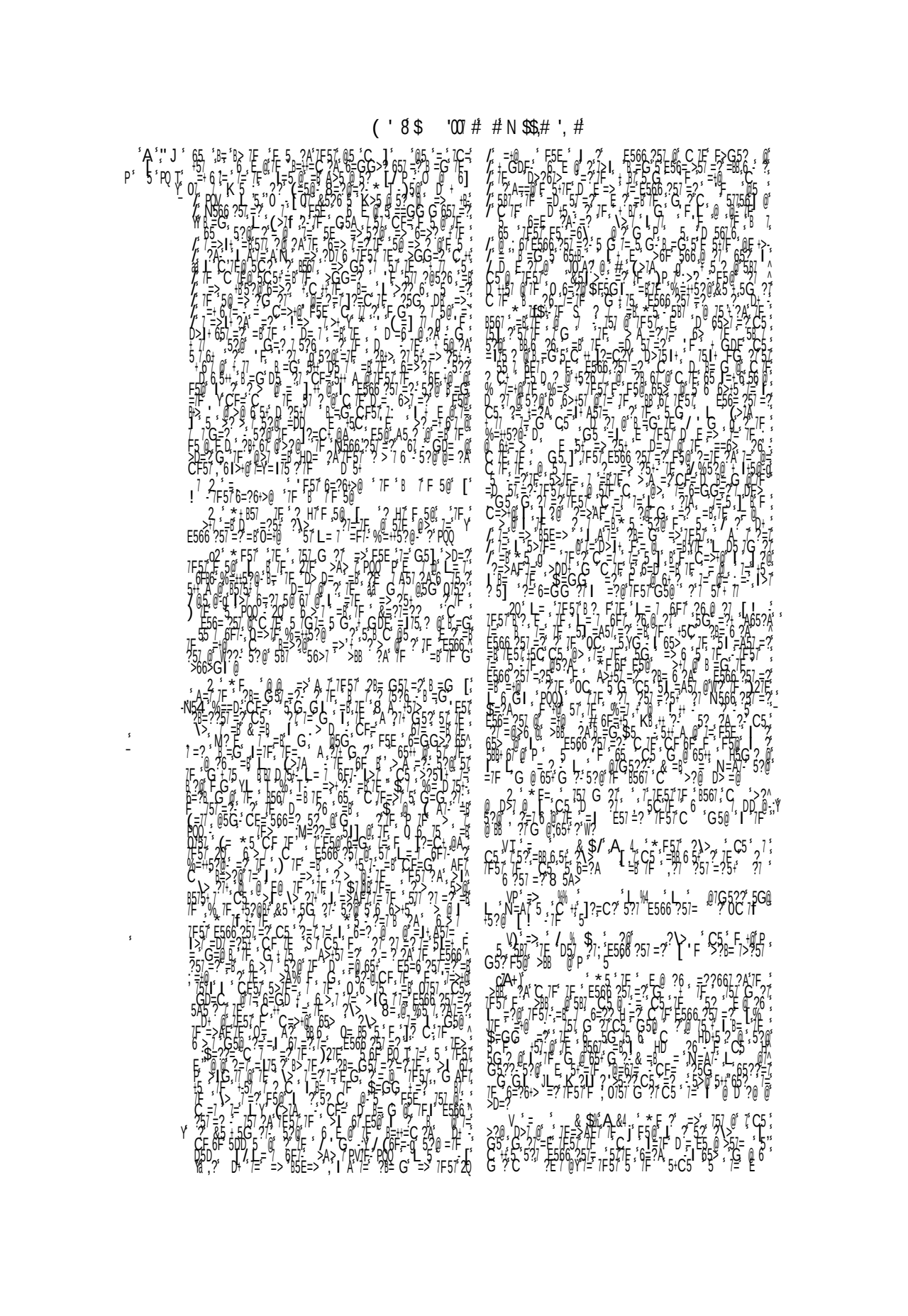

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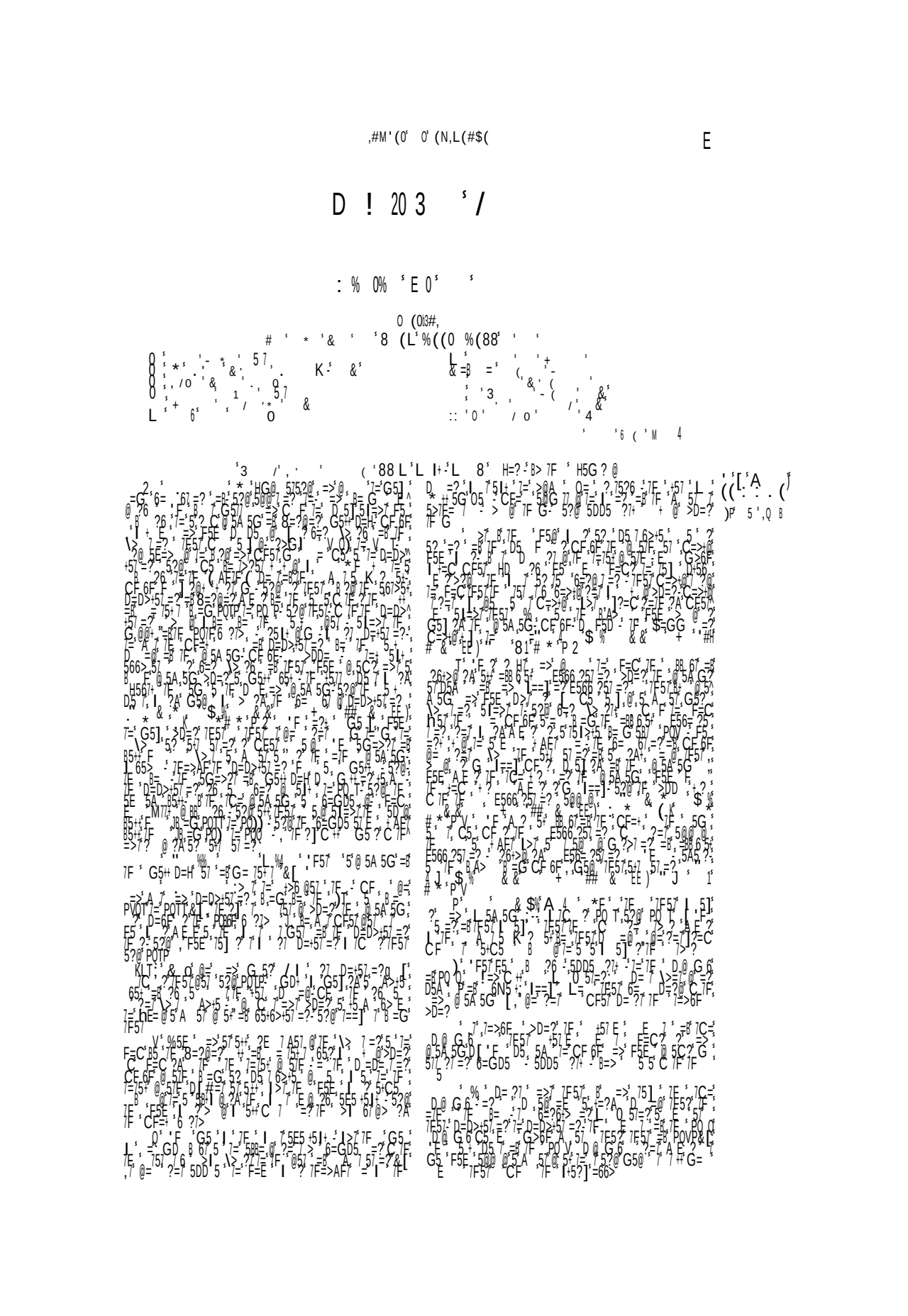

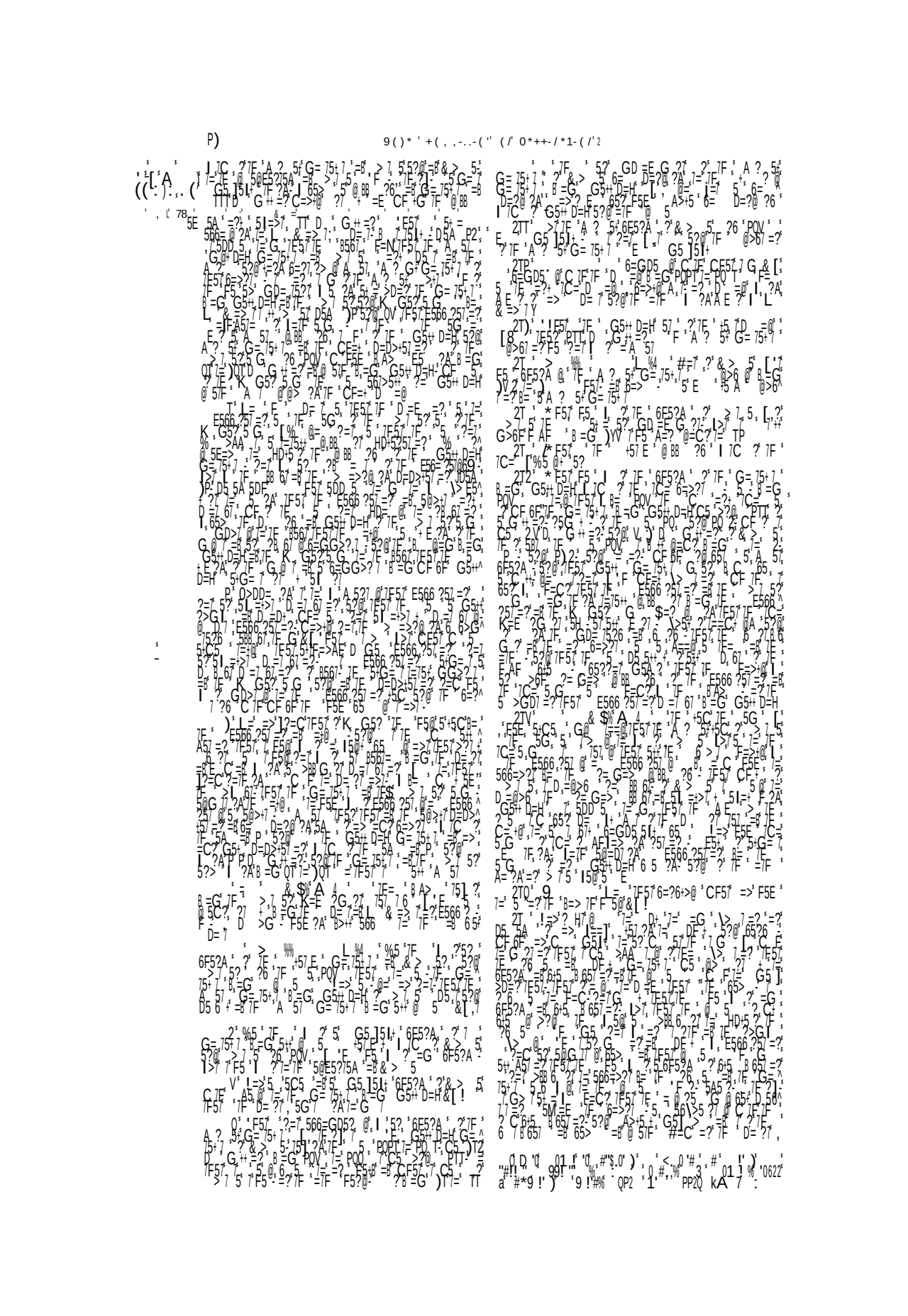

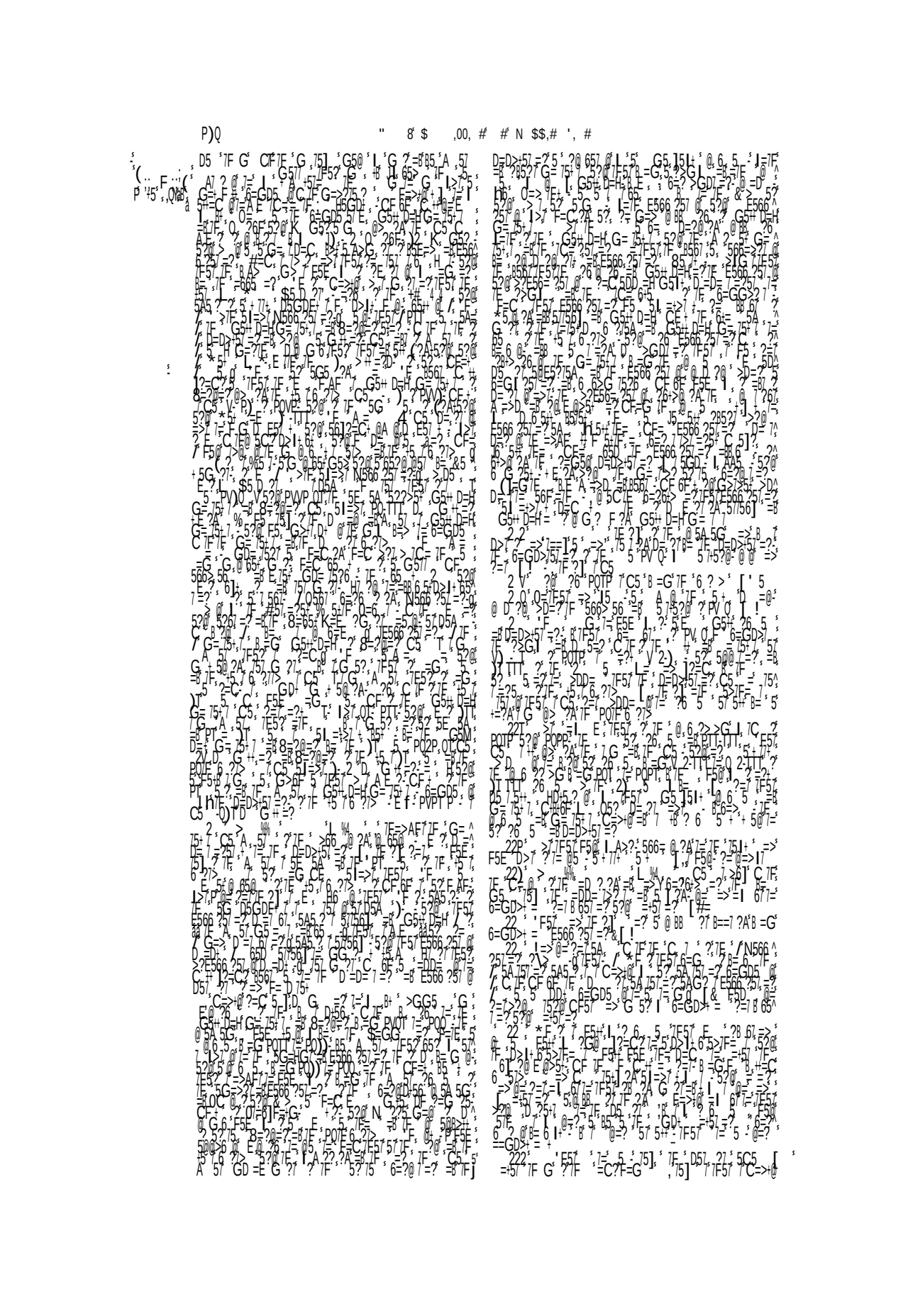

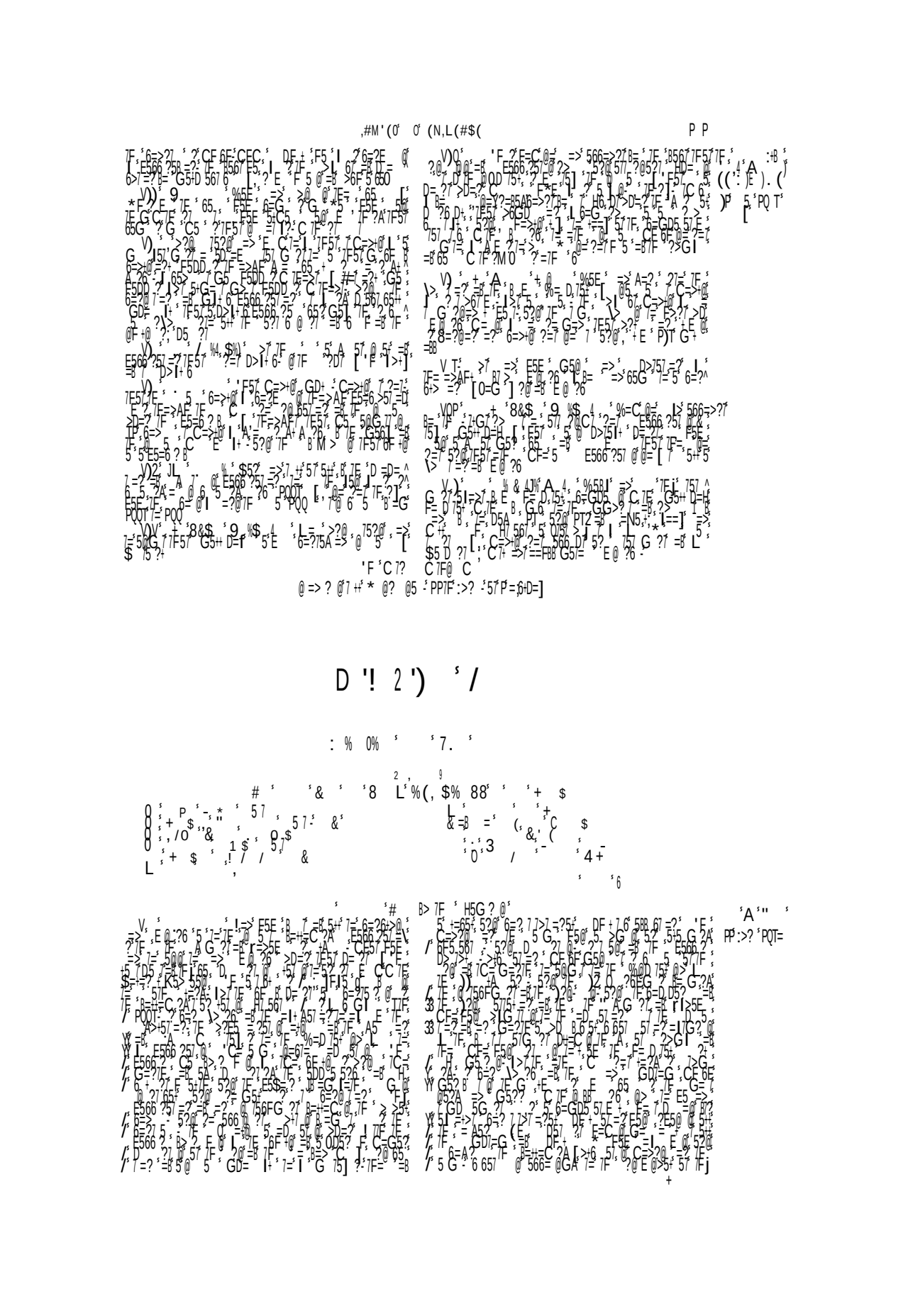

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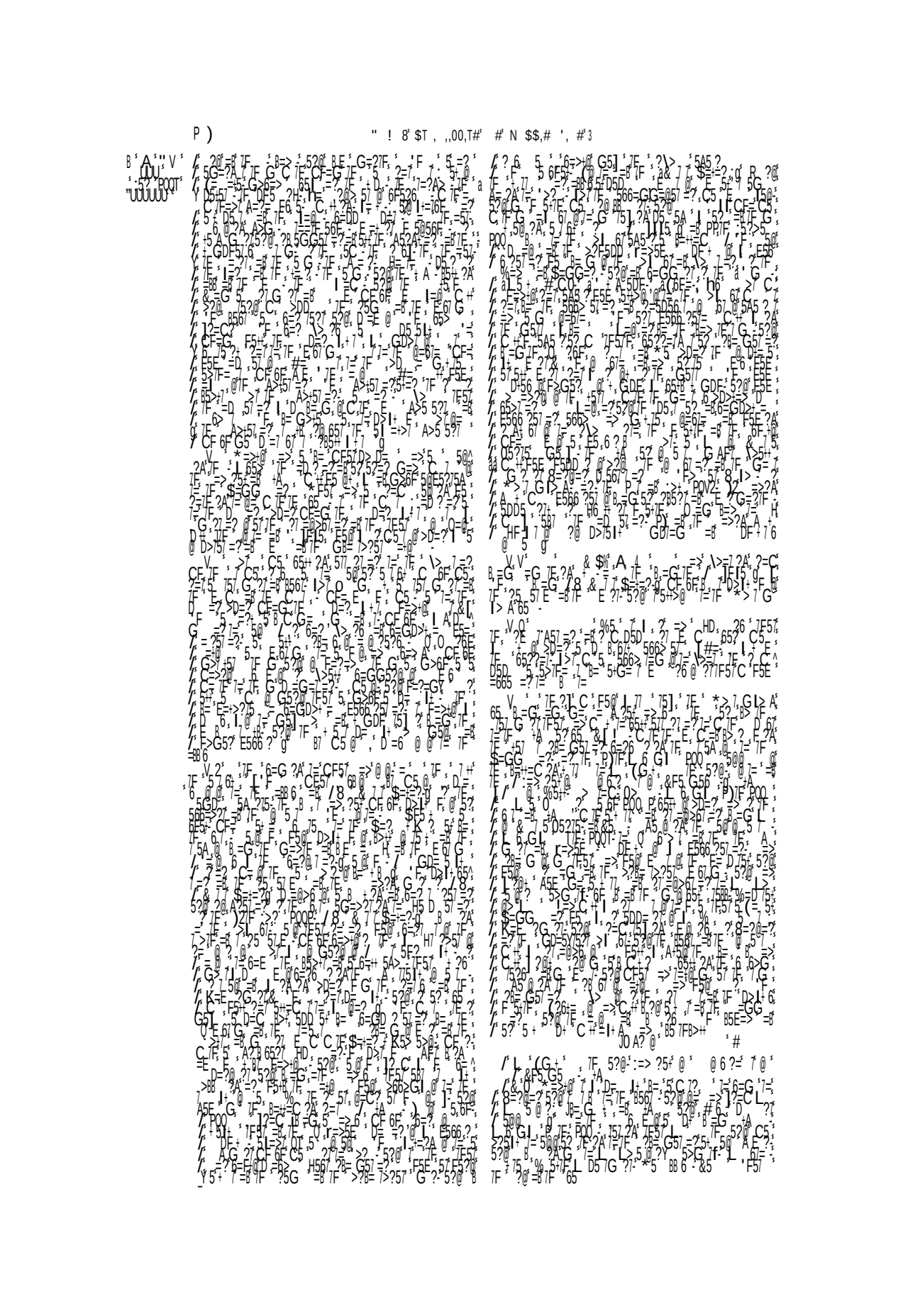

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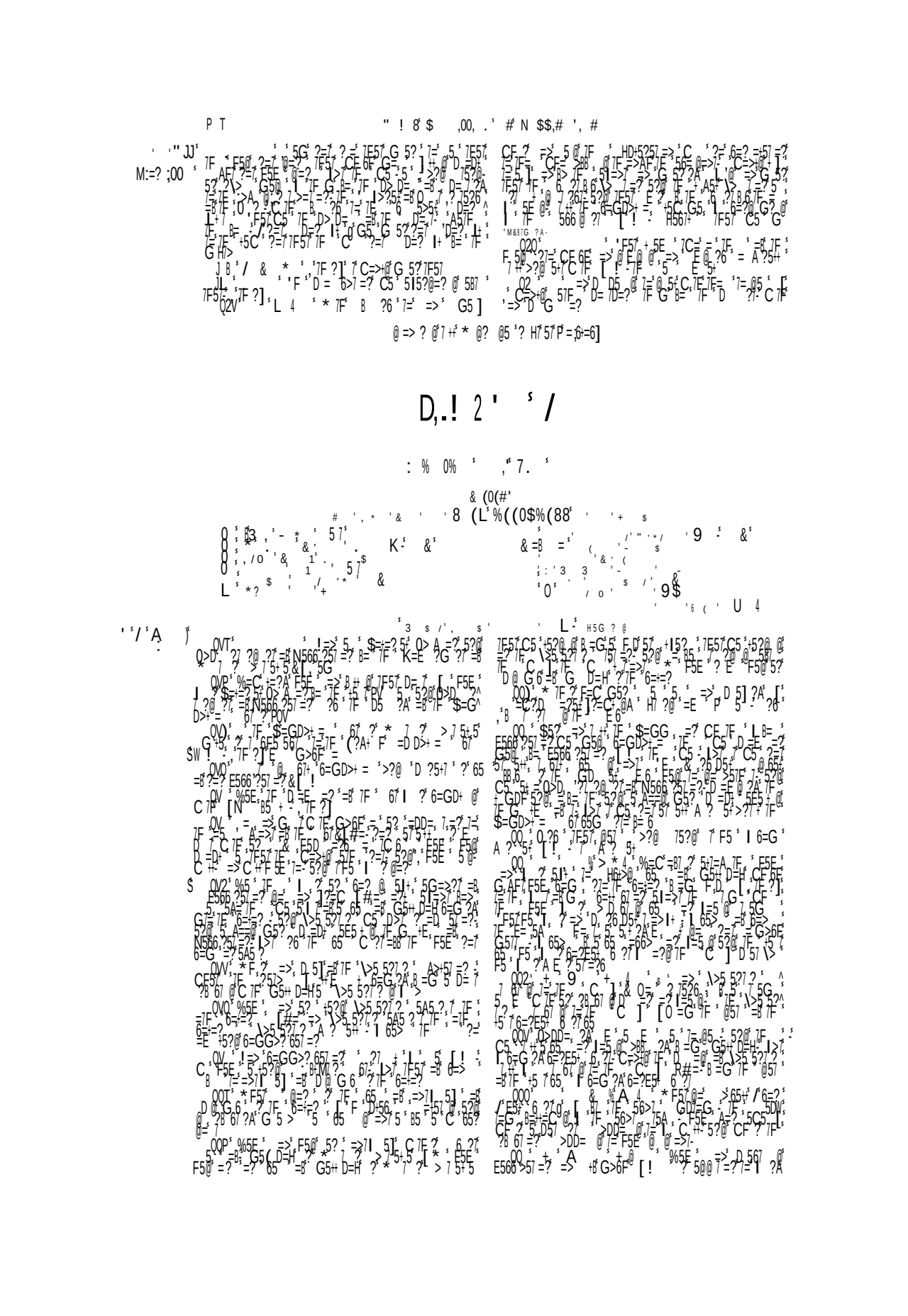

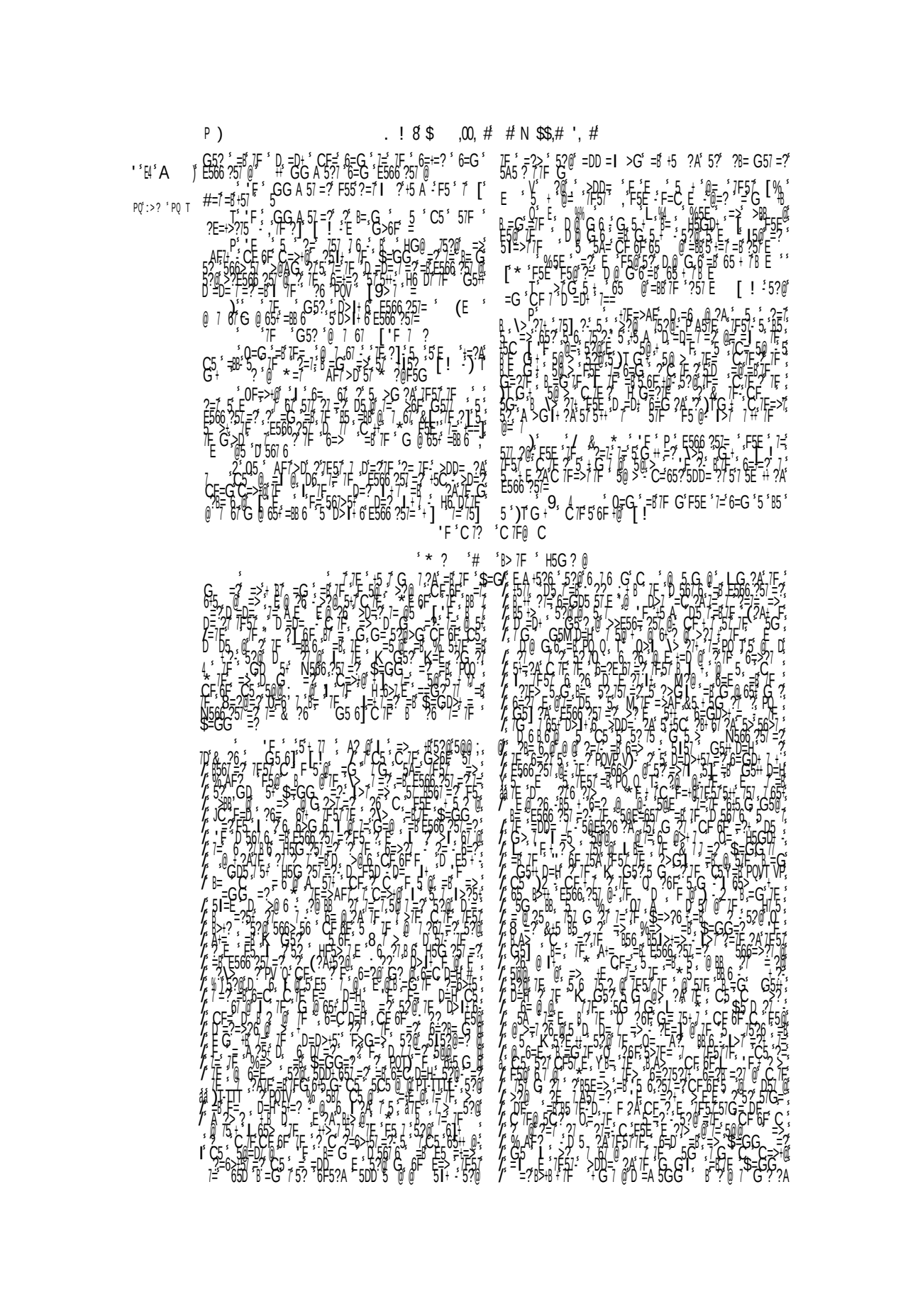

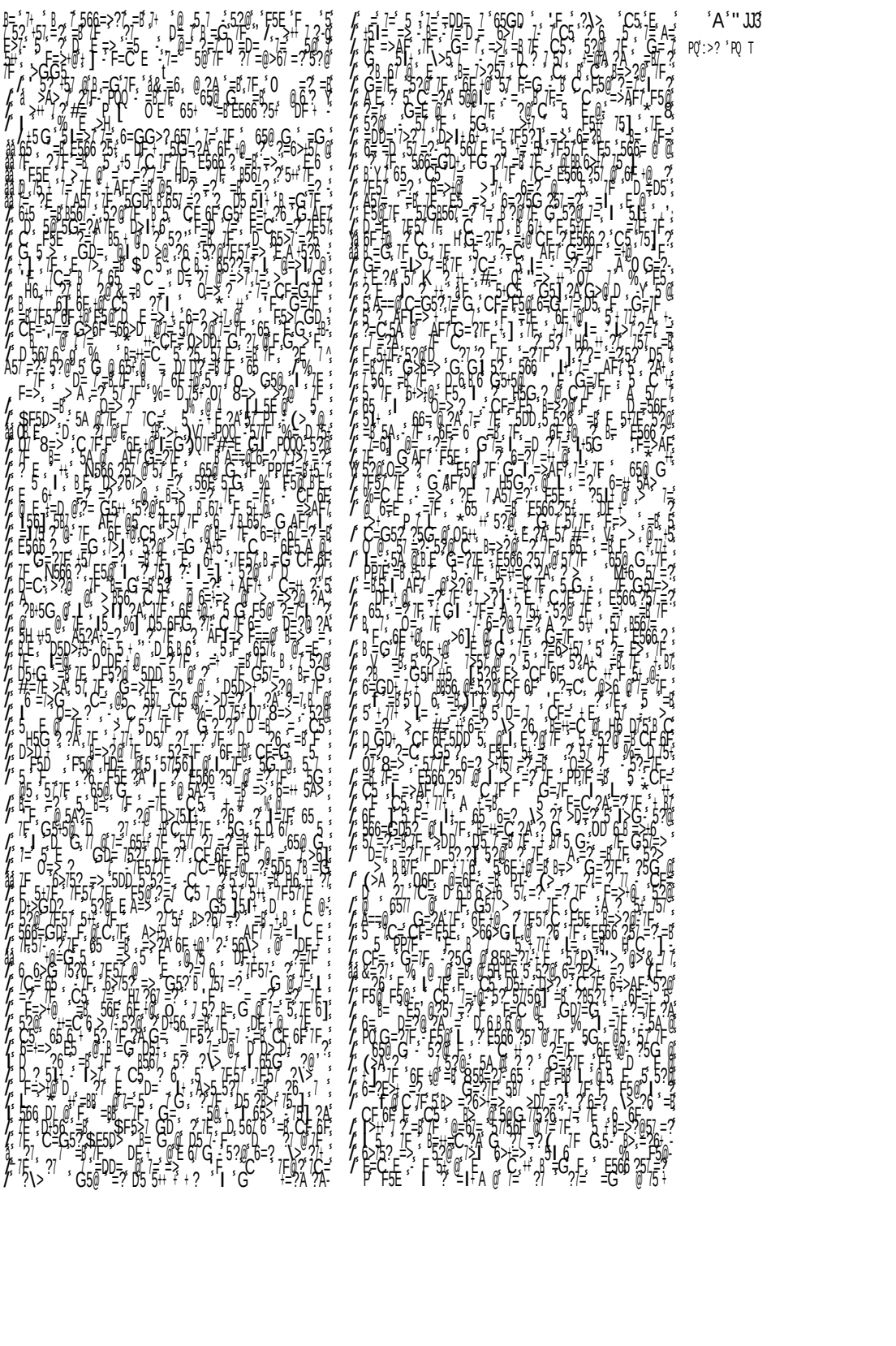

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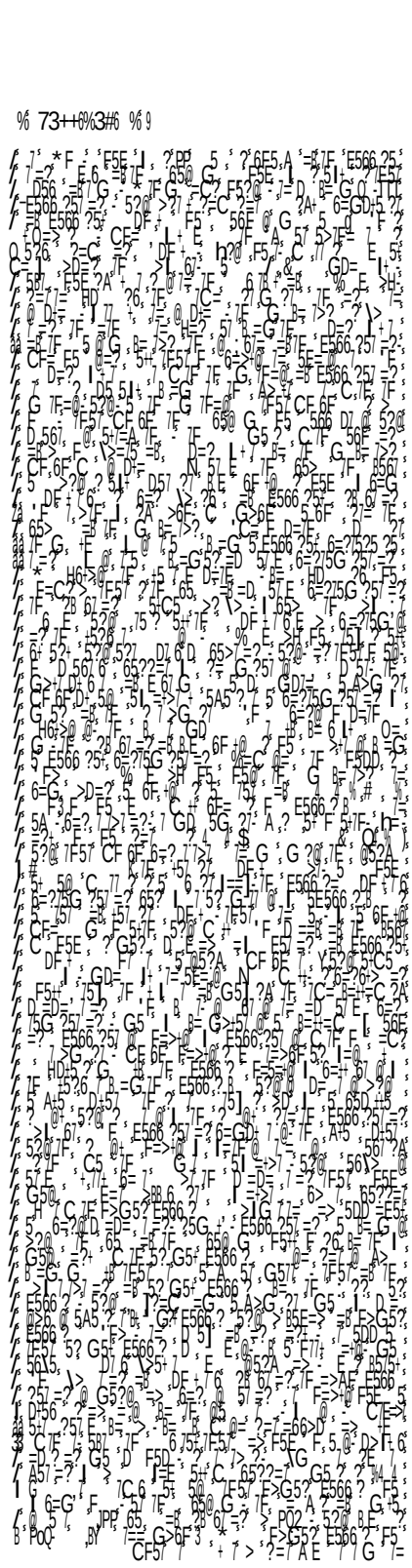

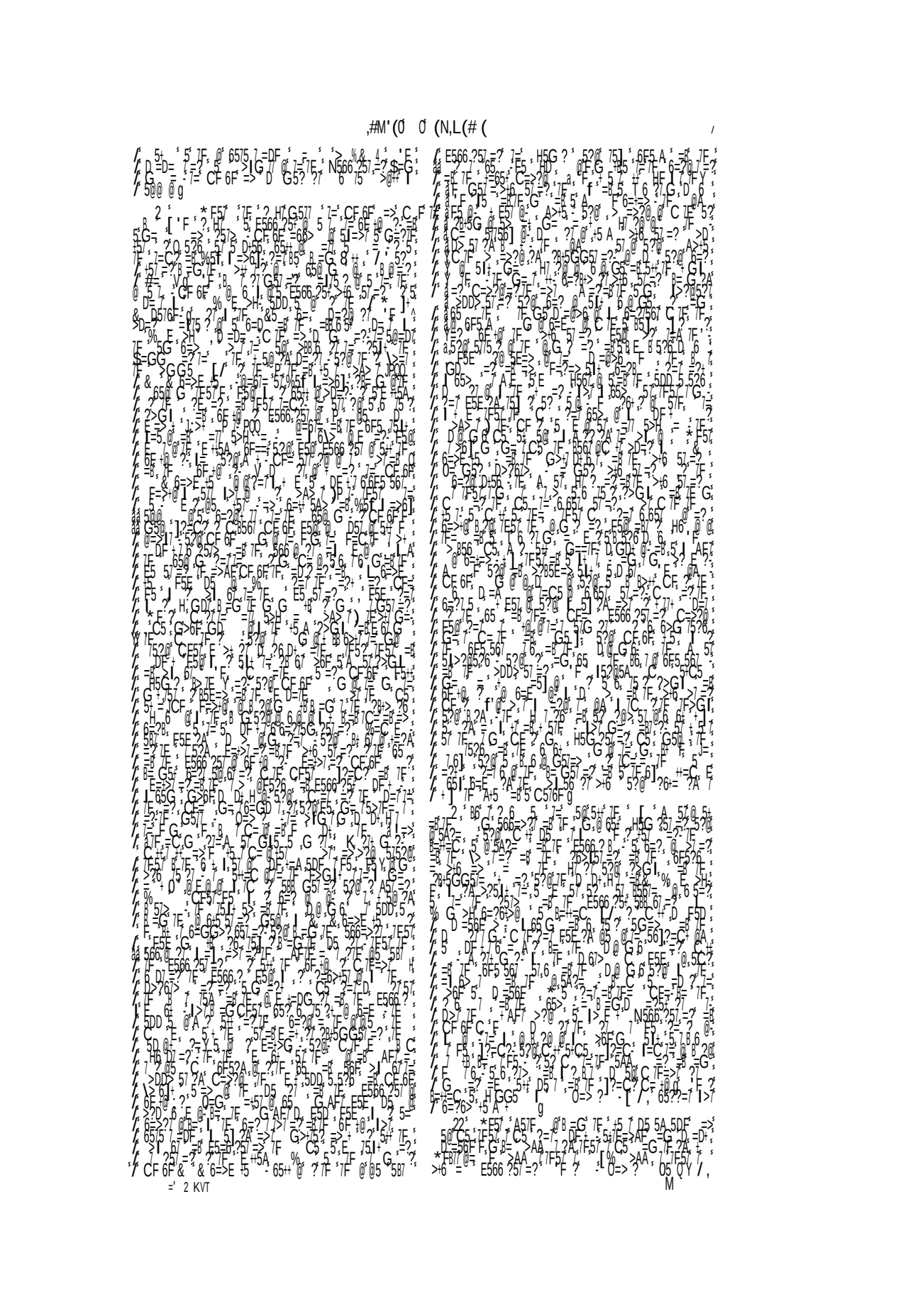

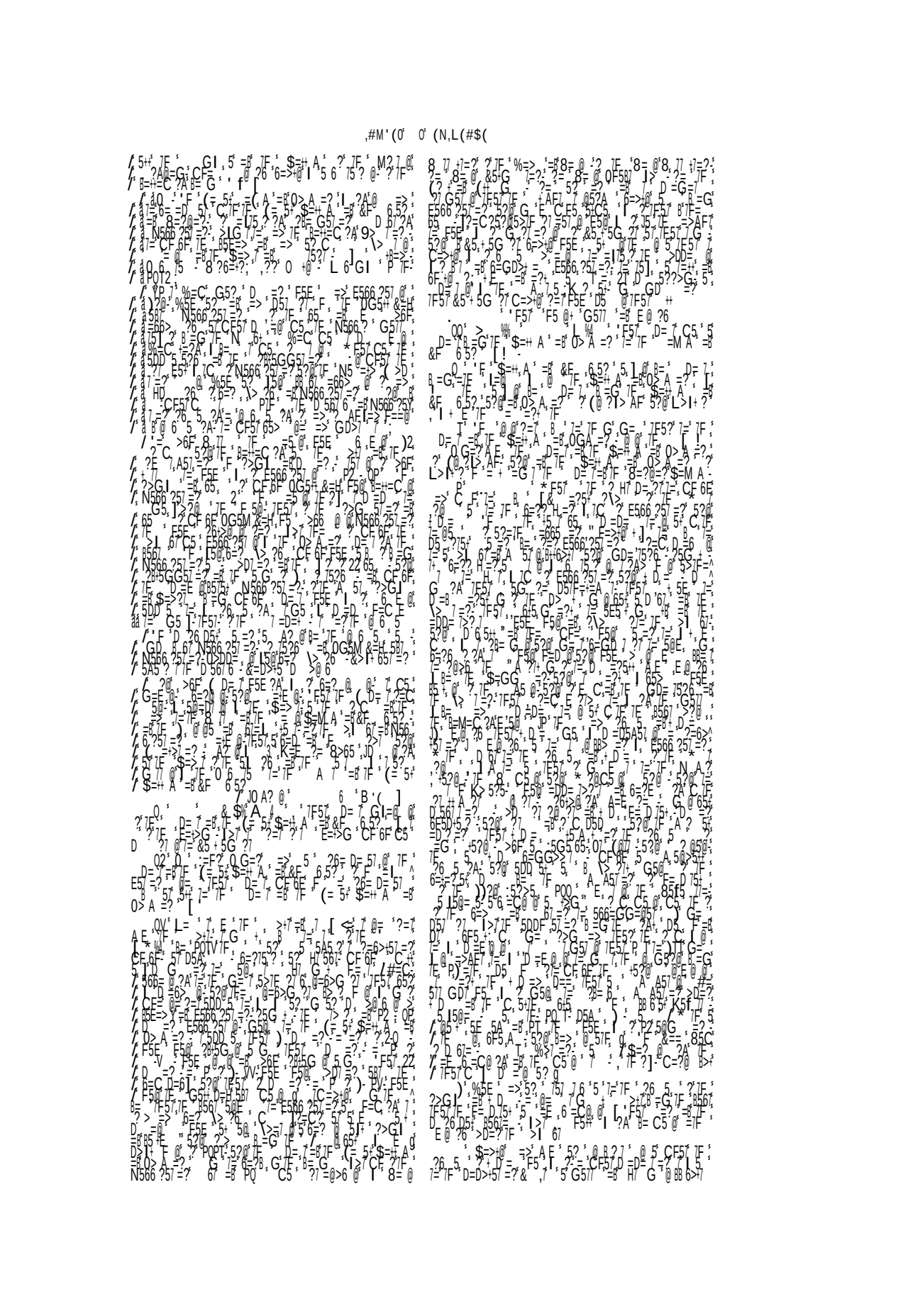

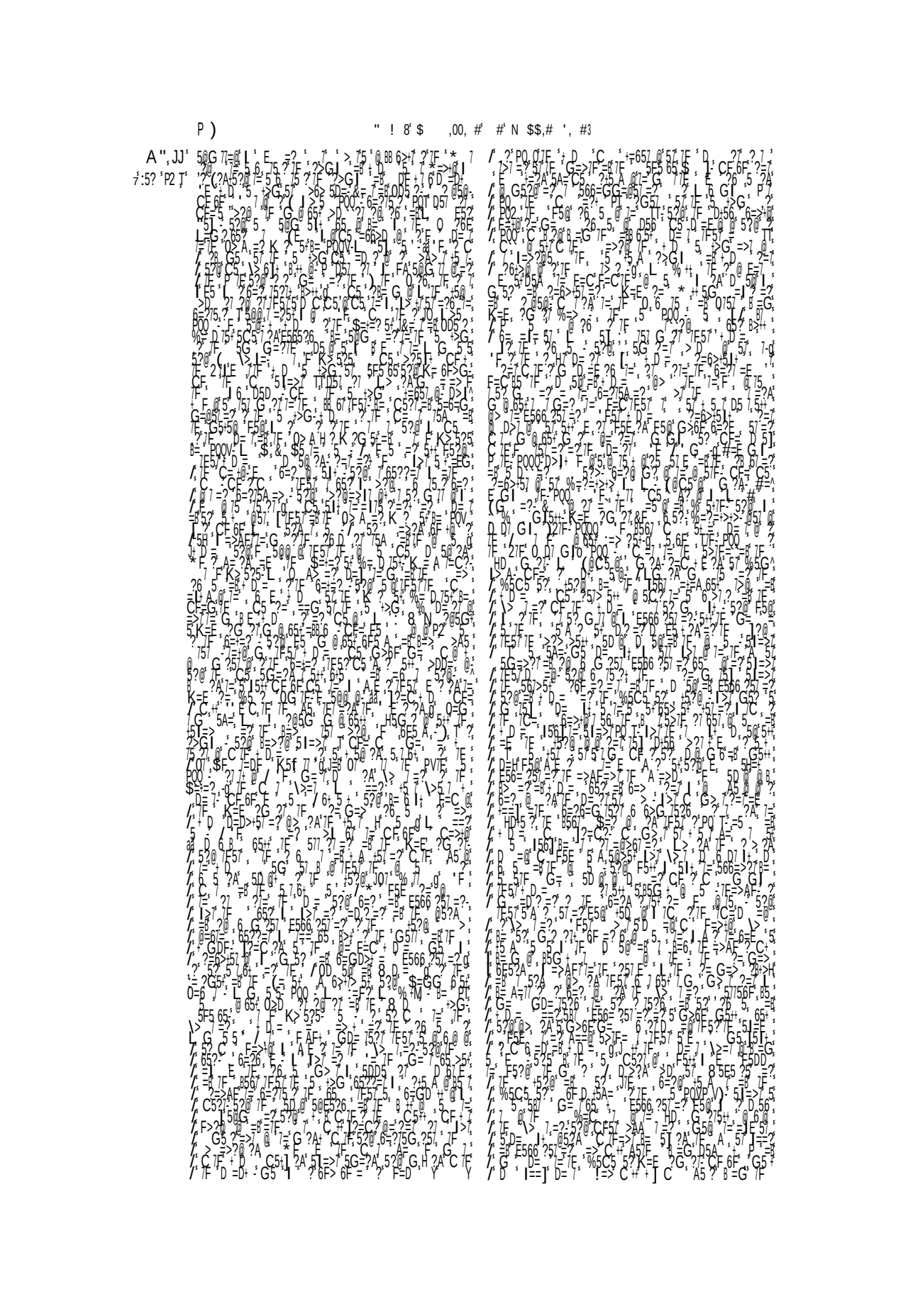

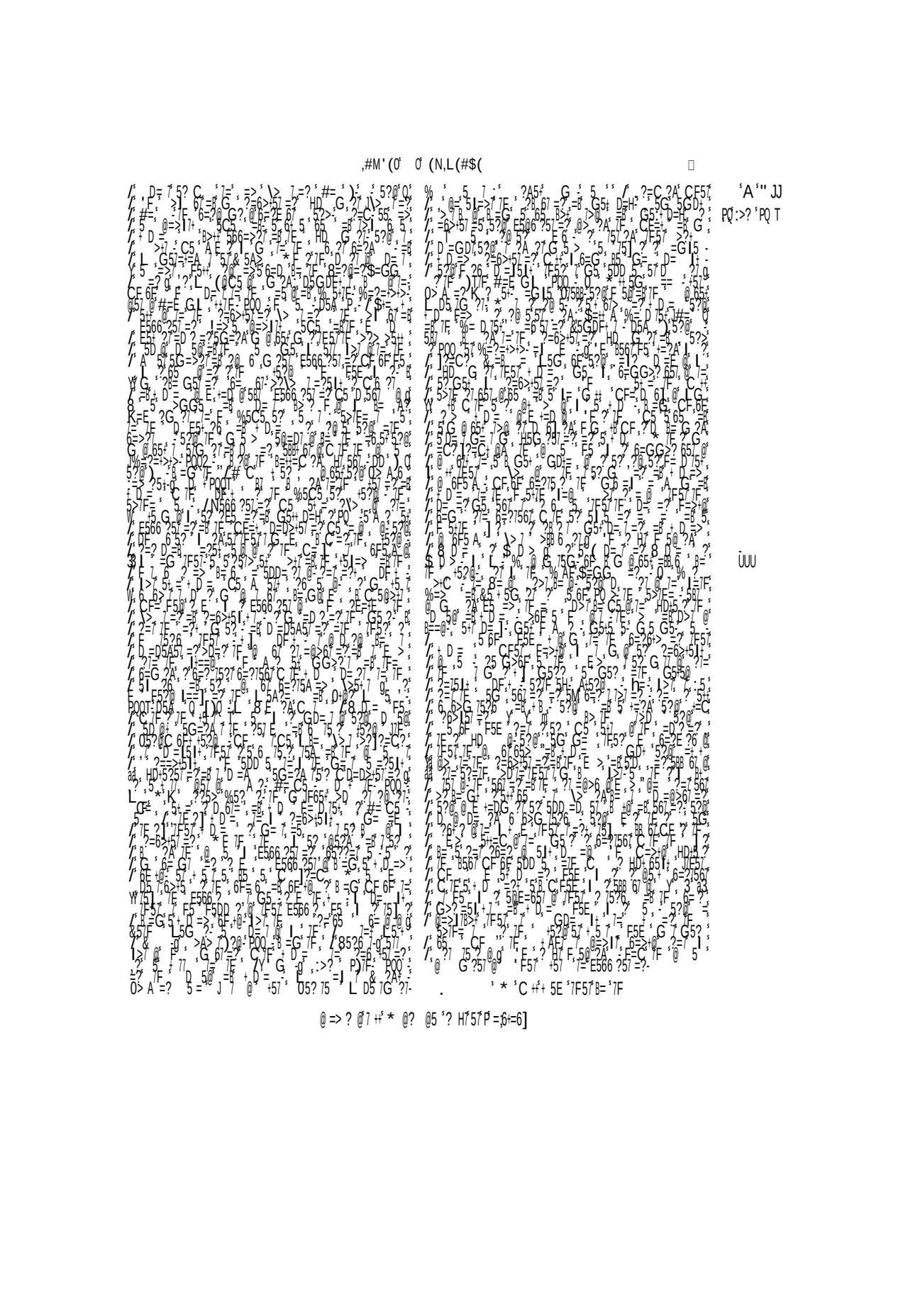

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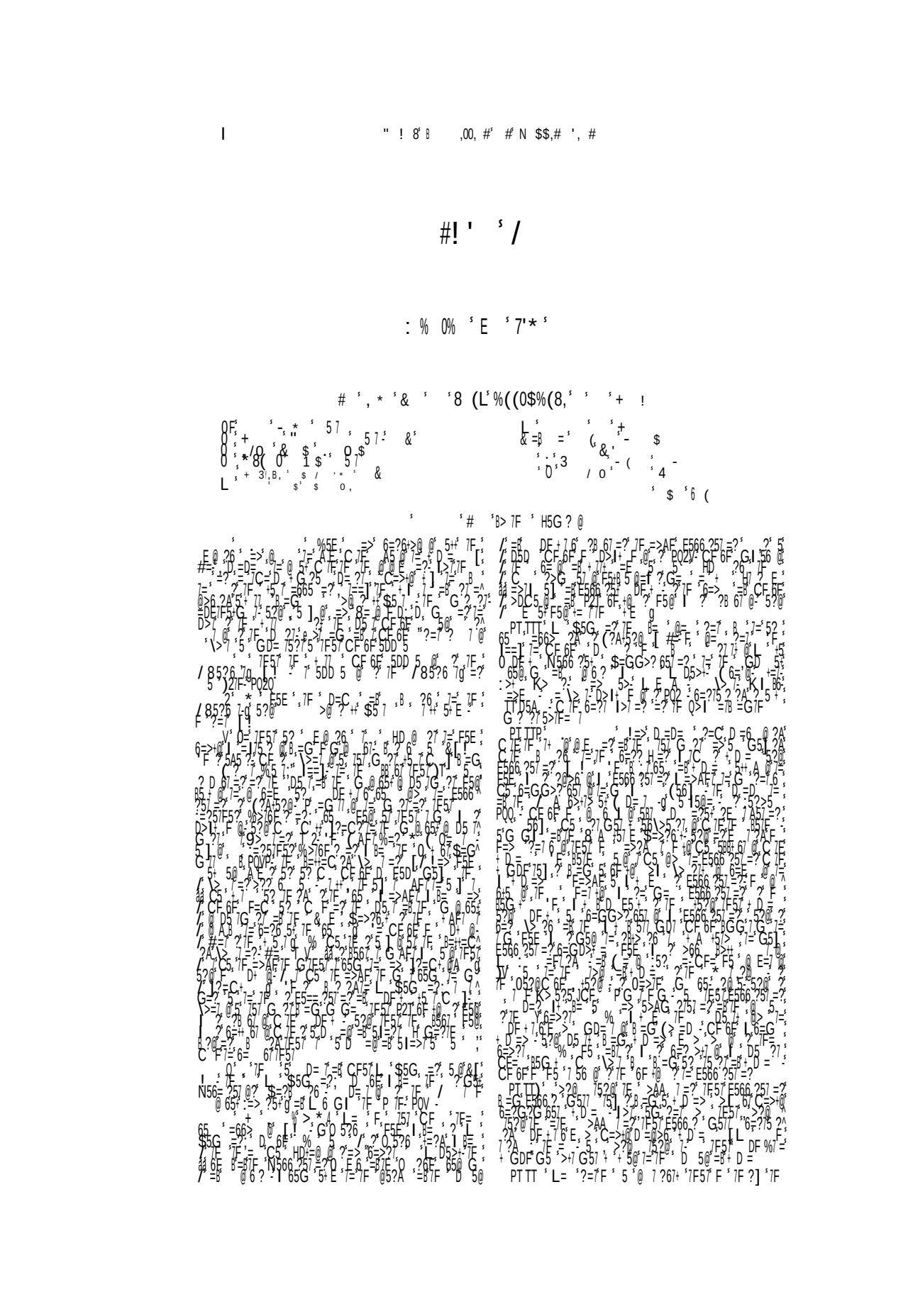

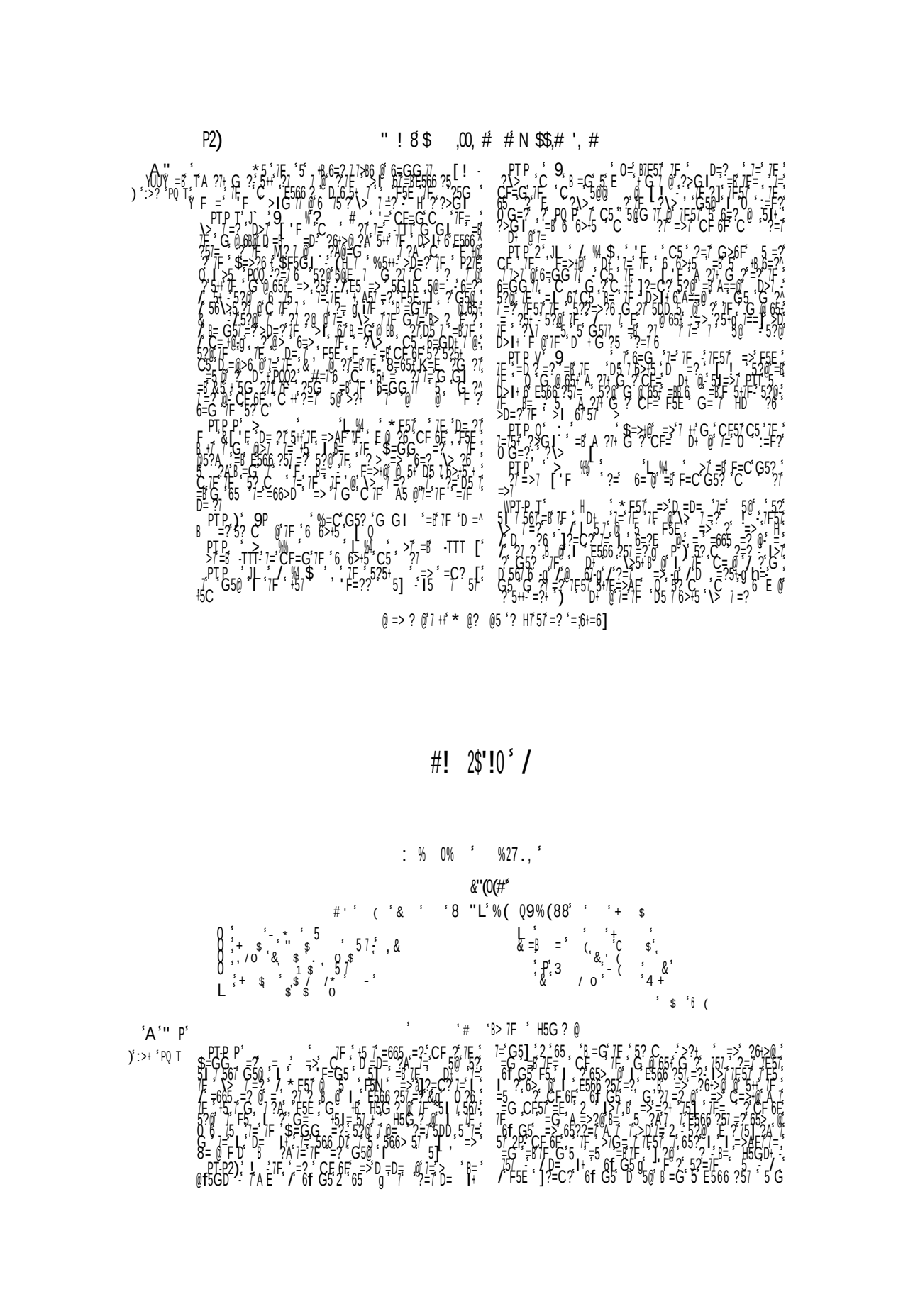

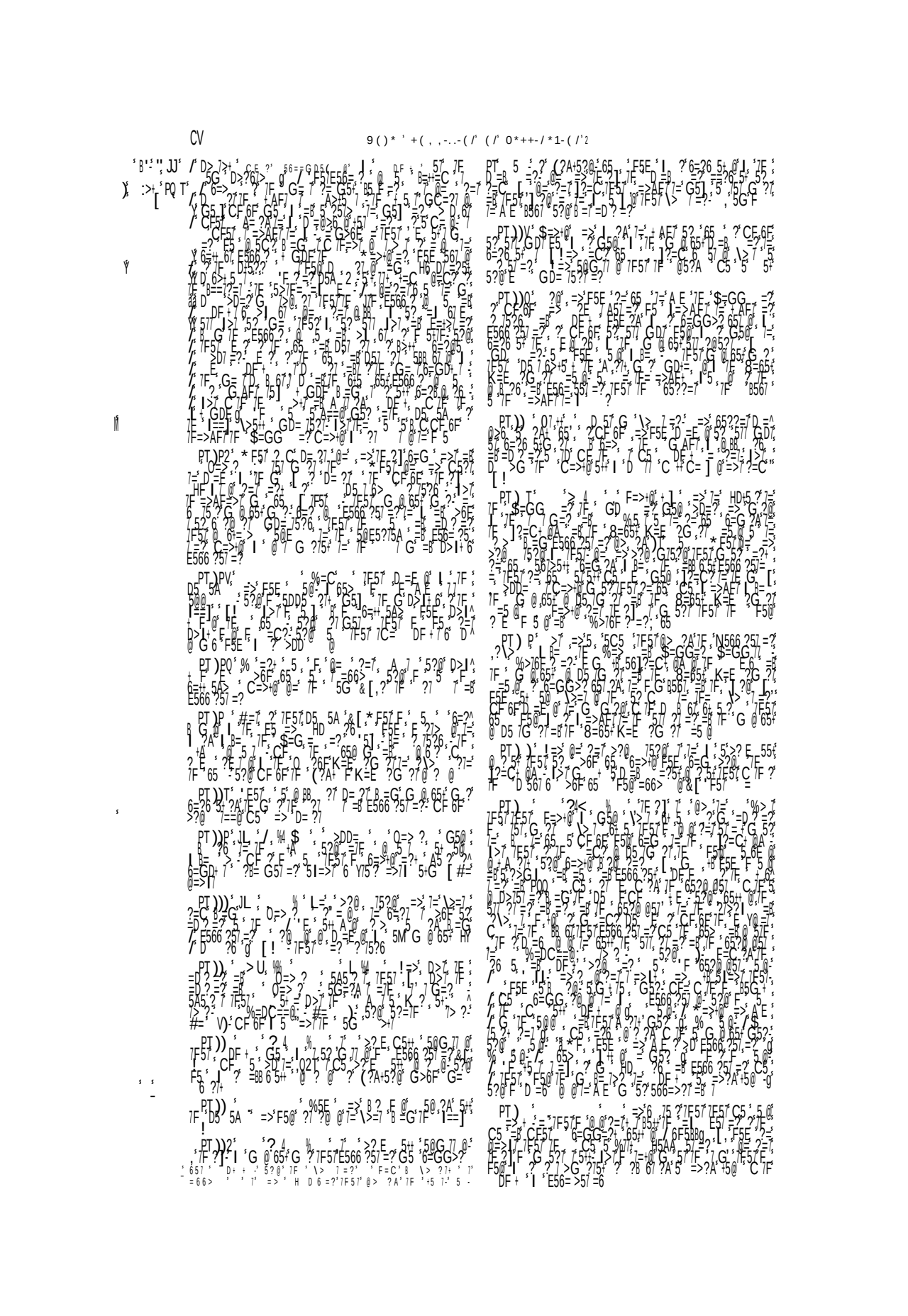

PT) 5 =? 5 J 5 =>F 5 > 5 7FF57 7F5 5 C5 5 ?=7 5 I 7 =8 5 F=5H 5 L 65> 5 =? 5 F5 5 F 5 @ 5 =# 65 5 ? 5 F 6F 5 C ++ ?A 5 >@ 5 F5 5 F5@ 5 5 7 5 B= 5 7 5 >D=? 5 F 6F 5 C 5 7 5 >D=? 5 F G 5 [5 G @ 65 5 C 7 5 C ++ 6=G 5 [5 B= 5 7 5 F 5 $=GG 5 =? 5 7 5 ++ 5 =>? 5 F=C 5 F 5 F5@ 5 7 5 G 5 B= 5 >? 5 7 5 DF 5 5 I 5 >7 5 >A 5 I 5 E566 5 257 5 =? 5 F 5 [5 =>AF 5 F 5 65 5 J 5 B= 5 7 5 F 5 $=GG 5 =? 5 7 5 F 5 D5 5A 5 =# 5 \ 5 >? 5 @ 5 65 5 =G 5 [5 AA 5 F G ?=[5 7 5 =? 5 @ 5 6 5 F 5 ++ 5 =? 5 @ 5 56 5 F 5 [5 D 5 B5 7F C 7F 5 F 5 G 5 B= 5 =G 5 5 ?=@ 5 F 5 ?F 5 F 5 D>[5 [5 F 5 @ 5 57 5 66= 5 >? 5 =# 7F 5 6 5 6>G 5 7?6 5 5 8 5 F 5 D=== 5 D5D 5 E57 5 A ?7 5 G5?7 5 D 5 D5 5 @ 5 7= 5 6=G 5 ?@ 7 5 B 5 7= 5 F B56?5 I 5 B= 5 7F 5 $=GG 5 =?

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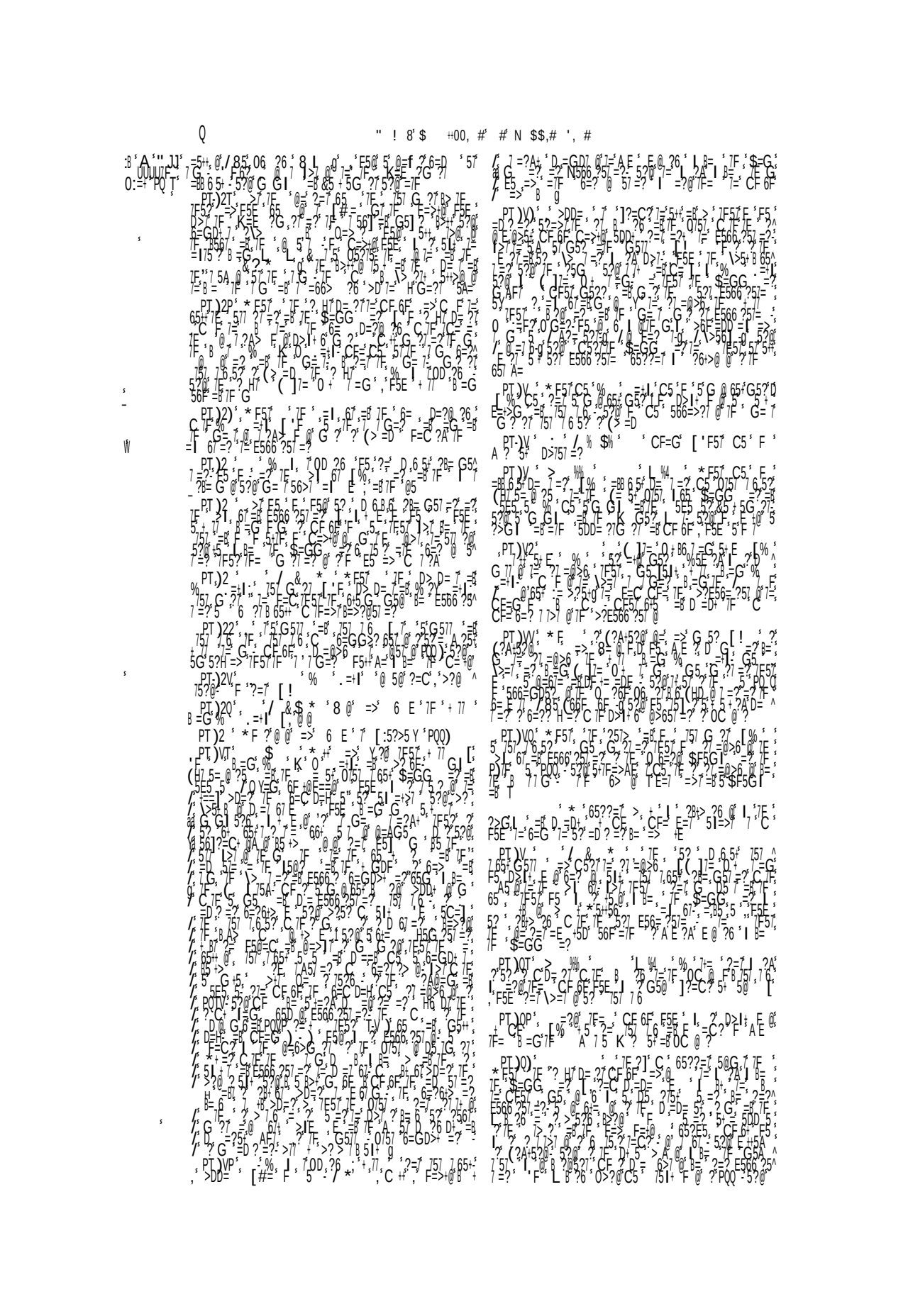

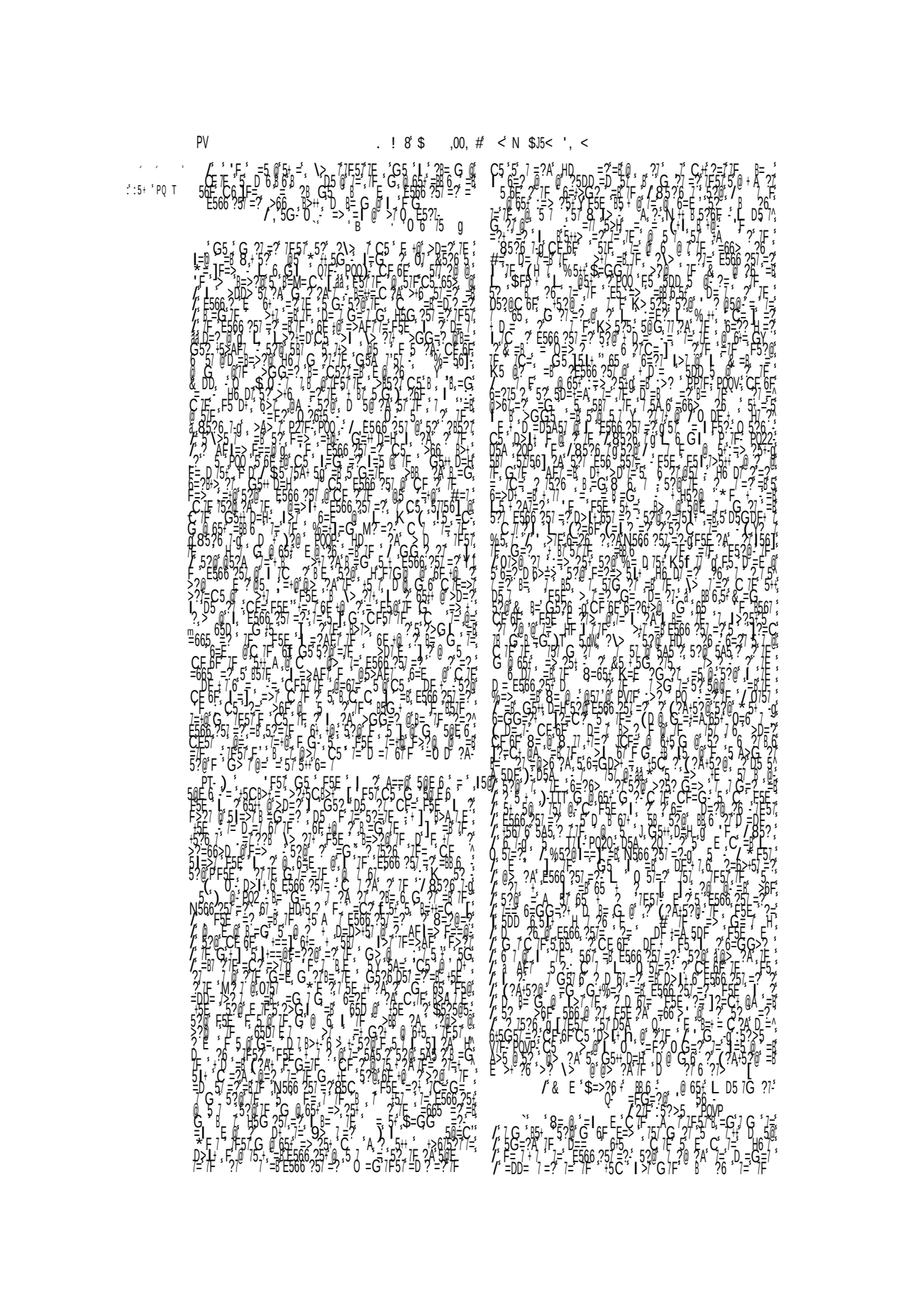

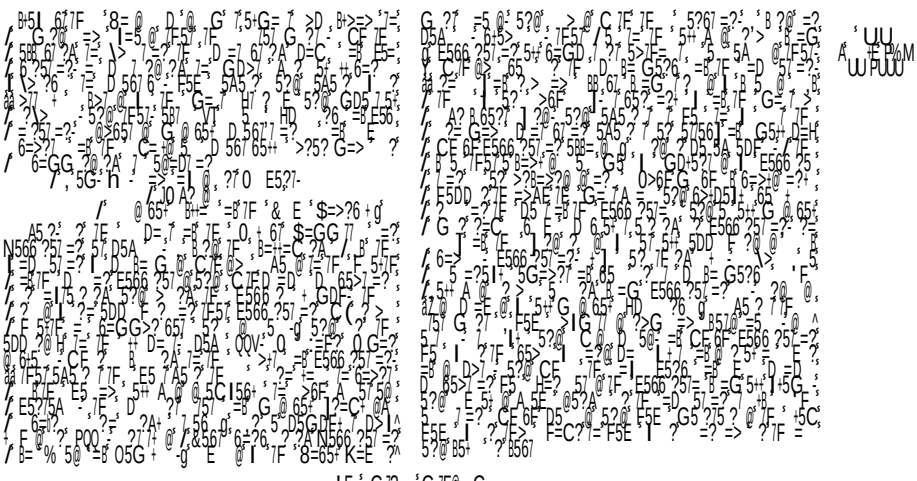

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L 5A 5G' $' 0G5++ D=H' ?' O6=7+5?@' @> ?A' 7F ' 5 ' PQ 2 ' ?' 7=C?' 5?@' 6=>?7 4 ' '# * ' PV
L 5A 5G' L ' 0C @ ?' 5' 6 ?7> '=B' G5++ D=H' ' ' U ' 4 ' '# * ' PV
L 5A 5G' (' & > 5 ' H7 ' 5 '=B' G5++ D=H' ' ' ' ' 4 ' '# * ' PV
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BL 5A 5G' K ' N566 ?57 -=?' 5?@' G5++ D=H' G= 75+ 7 ' ?' H7 E ?' L D5 7G ?7 ' -=B' & ,5?6 @> ?A' 7C ?7 5 4 '# * ' P

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' D=D= 7 -=?' -' B=' 7F ' 7C ?7 ' 5 ' -=B' E566 ?57 -=?' -' G' @' G5 + D=H' @ 57F ' 7 -=B' 7F ' ?' H7 '
' E ?' -=B' 7F ' L D5 7G ?7 ' + 5 7 5?@' G= 7 E566 ?57 @' D 67 E + ' B=' 7F ' 7 ?-' 7C ?7 -' 5?@' PQT
7+ 7 7F ' L D5 7G ?7 ' + 5 7 5?@' G= 7 E566 ?57 @' D 67 E + ' U 4 # * '

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G= 75+ 7 ' ?' 8=?@=?' D G ++ =?' -=B' 7F ' D=D>+57 -=?'
L 5A 5G' 8 ' &>I+ 6' E566 ?57 =?' ?' (?A+5?@' F>?@ @' 7F=> 5?@' =B' 7F ' D=D>+57 -=?' 4 '# * P V

'5I+ ' ' '5I+ ' F=C ?A-' B=' ' 56F' =B' 7F ' 5 ' PQV QV-' 7F ' ?>GI ' '=B' >66 B>' D G5 '
E566 ?57 -=?' -' 5?@' 7F ' ?>GI ' '=B' >66 B>' E566 ?57 -=?' -' I ' &>I+ 6' N566 ?57 - ?' (?A+5?@-'
C 7F 7F ' D =D= 7 -=?' -=B' 7F ' 7=75+ D ' 7 ?' 7F=> 5?@' -=B' 7F ' D=D>+57 -=?' U P V
L 5A 5G' # ' L 57F ' B =G' 5++ 65> ' '=B' 6F +@ ?' >?@ ' B E ' 5 ' '=B' 5A -' ?' 8=?@=?' B =G' PV T ' 4 # * P V
7=' PQ) -' 5?@' ?' (?A+5?@' 5?@' * 5+ ' B =G' PQ P QT' '
'5I+ ' ' '5I+ ' F=C ?A-' B=' ' (?A+5?@' 5?@' * 5+ ' B=' ' 56F' =B' 7F ' D =@' PQ P ' T-' PQ P 2T-'
PO2P VT-' 5?@' PQVP QT-' 7F ' G 5?' 5??>5+' D =D= 7 -=?' -=B' @ 57F ' B =G' 5++ 65> ' '=B' 6F +@ ?'
>?@ B E ' 5 '=B' 5A 7=' 5' F>?@ @' I 7F P V
'5I+ ' & ' '5I+ ' F=C ?A-' B=' ' 56F' =B' 7F ' D =@' P2) -' P22T V -' PV)O V-' PVVP QT-'
PQTP PT-' 5?@' PQ P -' 7F ' G 5?' 5??>5+' @ 57F ' ?' 8=?@=?' D =@>6 @' I ' 7C ?7 ' 6+5 =B' @ 5 '=>I' =B' 5' F>?@ @' 7F=> 5?@' + E ?A P Q

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L 5A 5G' ' L 5A 5G' F=C ?A-' B=' ' 8=?@=?' B=' ' 6 ,75 ?' D 6 B @' 5 -' 7F ' ?>GI ' '=B' @ 57F ' B =G' G5++ D=H' 5?@' 7F ' @ 57F 57 ' B =G' 5++' 65> ' D ' 7F=> 5?@' =B' 7F ' + E ?A' 4 ' '# *)TT
L 5A 5G' $' L 5A 5G' =C ?A' 7F ' 5??>5+' @ 57F 57 ' I ' O E ' ?' ,8=?@=?' D ' F>?@ @' 7F=> 5?@' + E ?A' 57' E ?' @ BB ?7' D =@ @> ?A' 7F ' 5 P2) PQ 4 '# *)TT
'5I+ ' L ' $=GD5 =?' =B' ?=6>+57 @' 5?@' ?57> 5+' G5++ D=H' ?' = 7=?-' 5 56F> 77 -' M O)TT
'5I+ ' (' '5I+ ' F=C ?A-' B=' ' 56F' =B' 7F ' 5 ' PQPP 2T-' 7F ' ?>GI ' '=B' @ 57F ' B =G' G5++^ D=H' ?' = 7=?-' 5 56F> 77 -' M O)TT
L 5A 5G' Q ' L 5A 5G' F=C ?A-' B=' ' (?A+5?@' 5?@' * 5+ ' B=' ' 56F' =B' 7F ' 5 ' PQ T QQ-' 7F ' @ 57F 57 ' B =G' G5++ D=H' 5?@' B =G' 5++' 65> ' D ' G ++ =?' -=B' 7F ' + E ?A' C ,7F 7F ' ?>GI ' D>I+ 6' E566 ?57 =?' D F>?@ @' 7F=> 5?@' =B' 7F ' + E ?A' ?' 56F' =B' 7F ' 5 ' PQ) QV 4 '# * □
L 5A 5G' K ' L 5A 5G' F=C ?A-' B=' ' (?A+5?@' 5?@' * 5+ ' B=' ' 56F' =B' 7F ' 5 ' PQ T QT-' 7F ' @ 57F 57 ' D ' G ++ =?' -=B' 7F ' + I ?A' B =G' 5++' 65> @ E @ @' 566= @ ?A' 7=' L ' O 5 ' ,' 6+5 B ^ 657 =?-' C 7F 7F ' G 5?' 5??>5+' 57 ' B=' 7F ' 5 ' PQQP QV' 4 '# * □
L 5A 5G' % ' L 5A 5G' F=C ?A-' B=' ' (?A+5?@' 5?@' * 5+ ' B=' ' 56F' =B' 7F ' 5 ' PQ T Q -' 7F ' @ 57F 57 ' D ' G ++ =?' -=B' 7F ' + E ?A' B =G' 5++' G=7 6' @' 5 ' @ E @ @' ,?7=' E ?' 6+5 ' C 7F 7F ' G 5?' 5??>5+' 57 ' B=' 7F ' 5 ' PQQ QV' U 4 '# *

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'5I+ ' ' '5I+ ' F=C ?6 7F ' B5 75+7 ' = ' D 6 >75A ' G @ 57F ' 7=' 65 ' =B D : ?? 5? ?57>' 5+ G5++ D=H)TP

'5I+ ' ' '5I+ ' F=C ?A 7F ' B575+7 ' = ' D 65?75A ' =B @ 57F ' 7=' 65 ' =B D= 7 : ?? 5>' %= D 75+ G5++ D=H)TP

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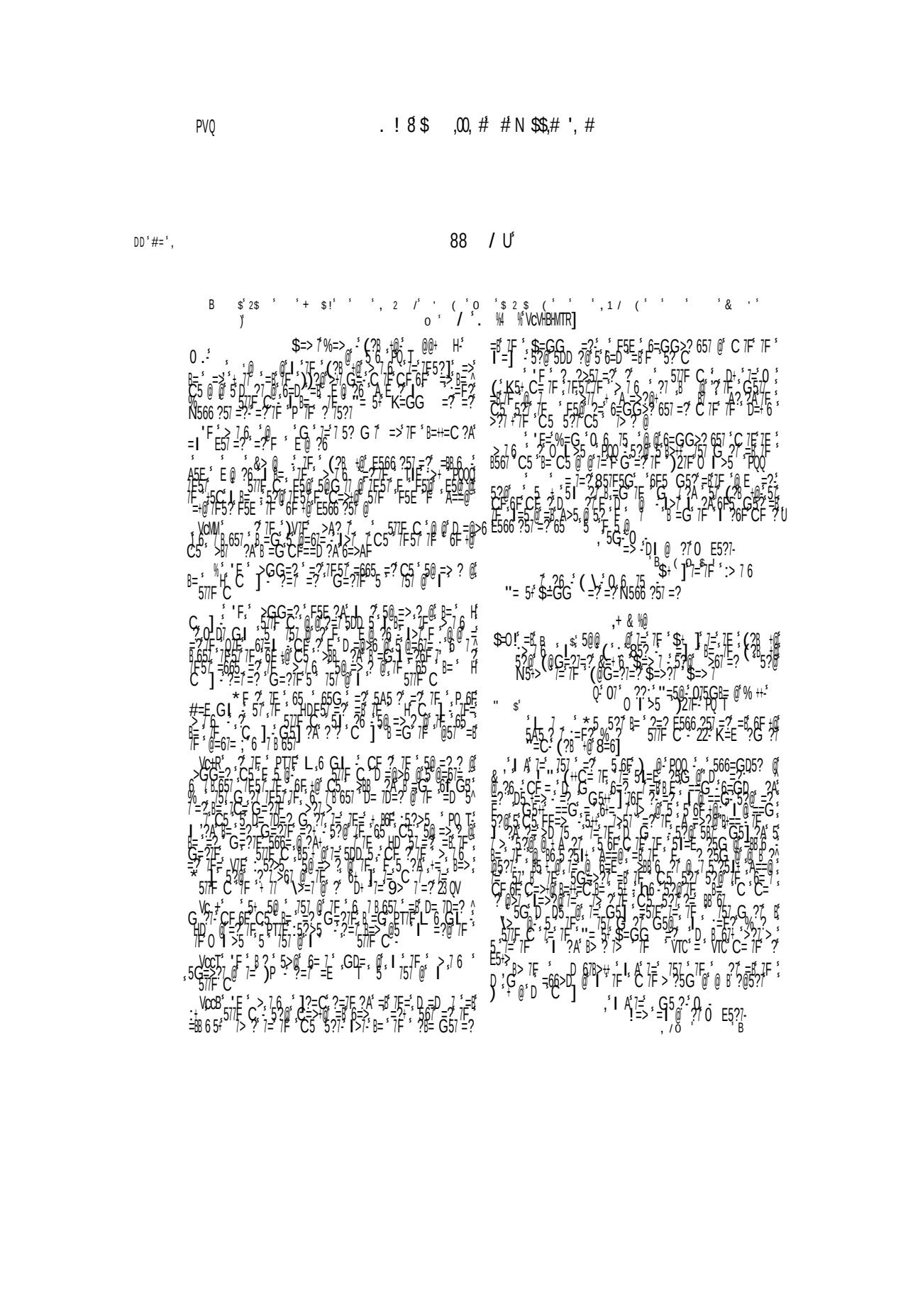

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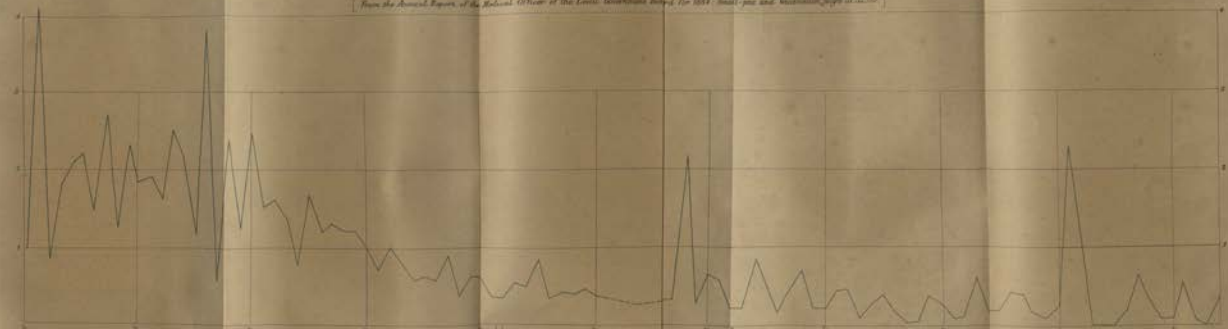
Mortality Thousands per Million.

DIAGRAM A.

A CENTURY OF LONDON SMALL-POX.

[From the Annual Report of the Medical Officer of the Local Government Board for 1884: Small-pox and Vaccination, pages 31, 32, 33.]



Below page 170

App. N°8.

DIAGRAM D.

SWEDEN: A CENTURY OF SMALL-POX.

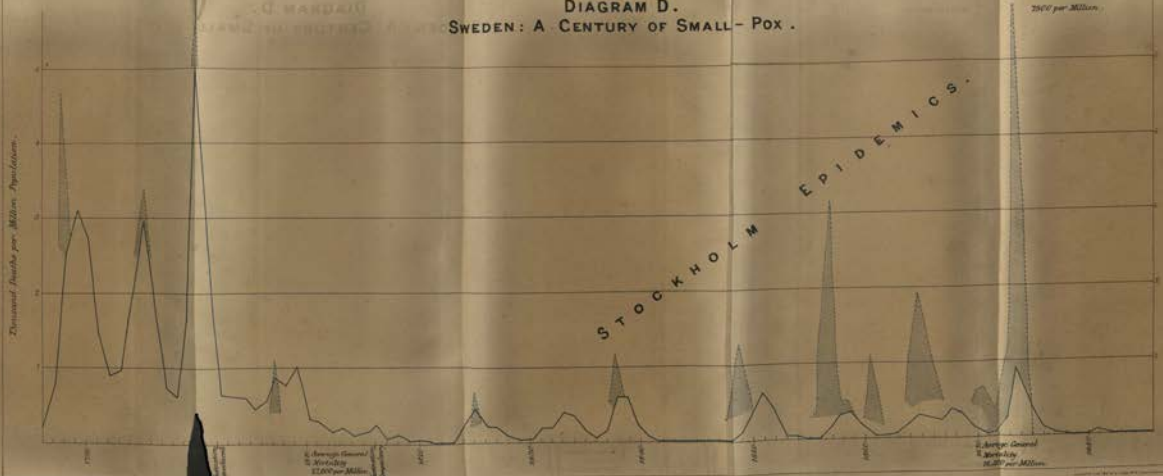
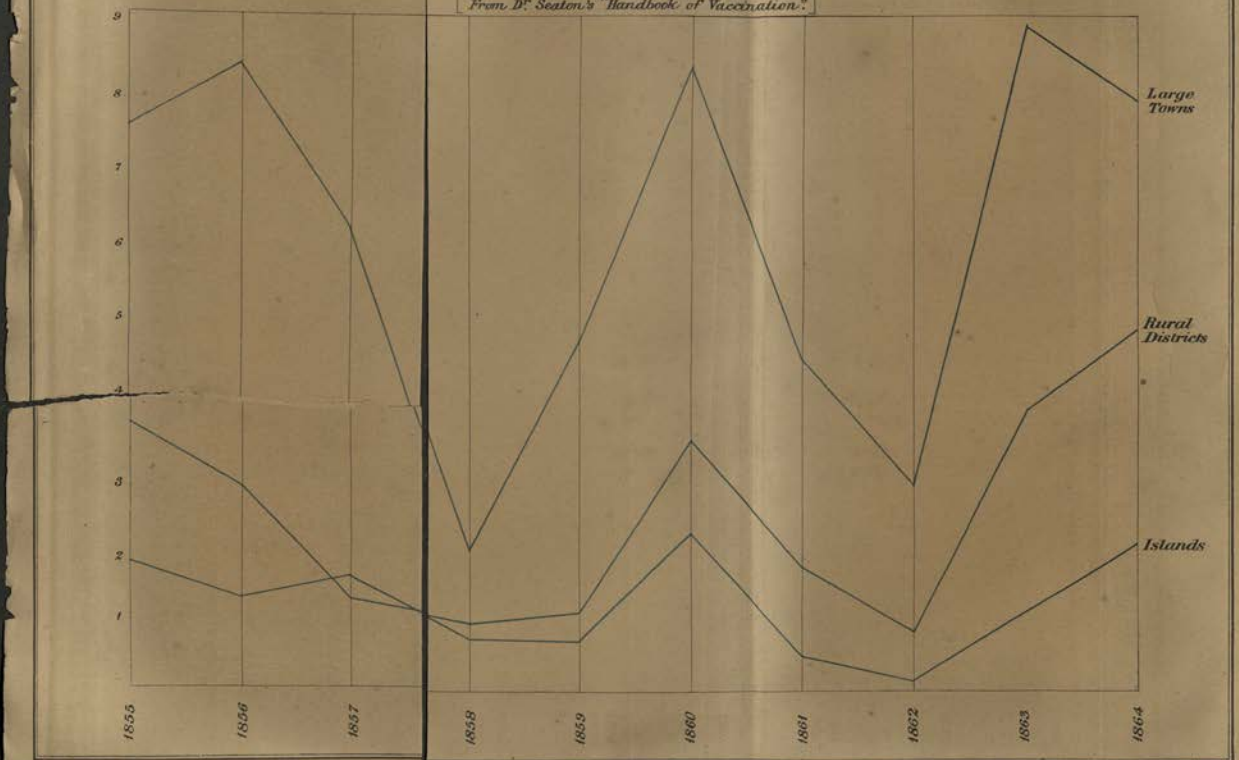

Thousand Deaths per Million Population.
STOCKHOLM EPIDEMICS.
2960 per Million.
Average General Mortality 17,000 per Million
Average General Mortality 16,870 per Million

DIAGRAM C.

SMALL-POX IN SCOTLAND DURING THE YEARS 1855–64: IN TOWN AND COUNTRY.

From Dr. Seaton's "Handbook of Vaccination".



To face page 179.

App. N°8.

DIAGRAM D.

SWEDEN: A CENTURY OF SMALL-POX.

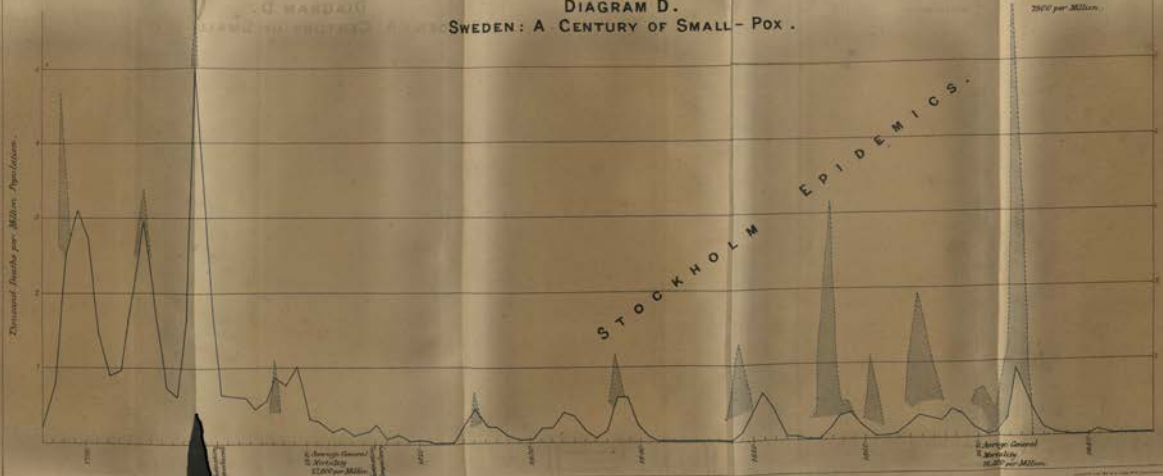
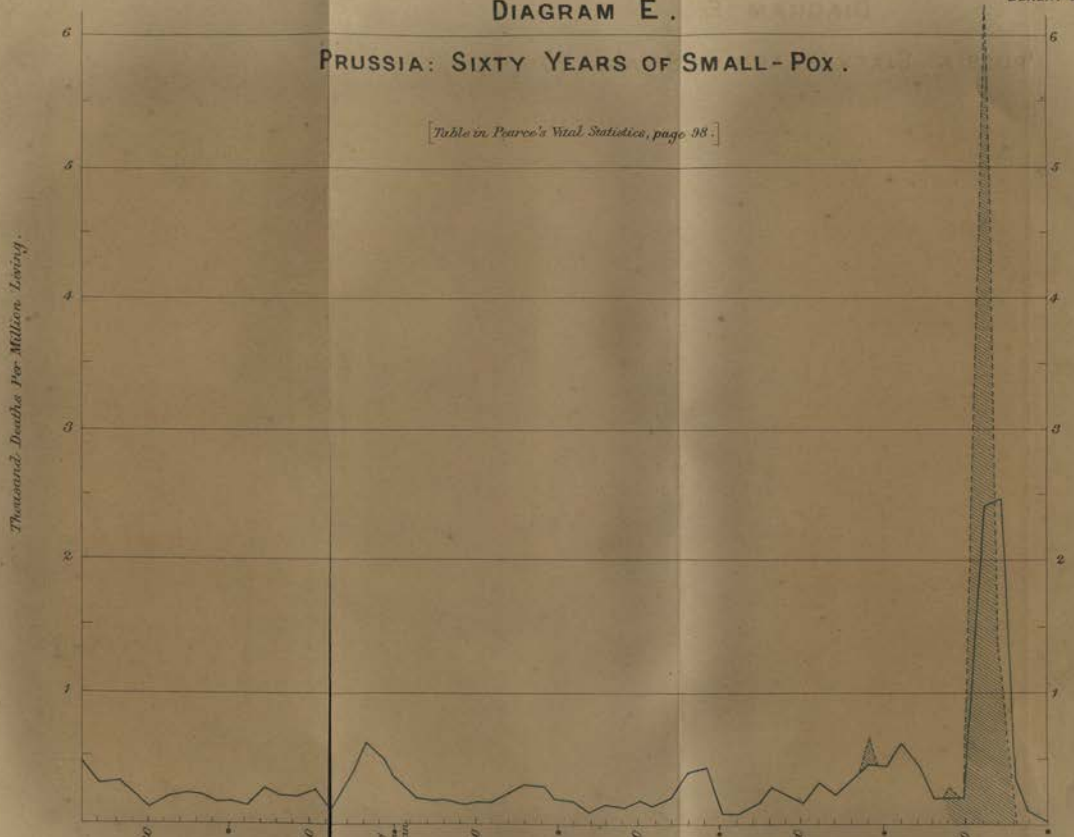

Thousand Deaths per Million Population.
STOCKHOLM EPIDEMICS.
2960 per Million.
Average General Mortality 17,000 per Million
Average General Mortality 16,870 per Million

DIAGRAM E.

PRUSSIA: SIXTY YEARS OF SMALL-POX.

[Table in Pearce's Vital Statistics, page 98.]

BERLIN EPIDEMIC.



To face page 179.

DIAGRAM F.

VIENNA: FIFTY YEARS OF SMALL-POX.

[From tables of Dr. Voght of Berne given in Pearce's Vital Statistics, Page 107.]

To page 179.

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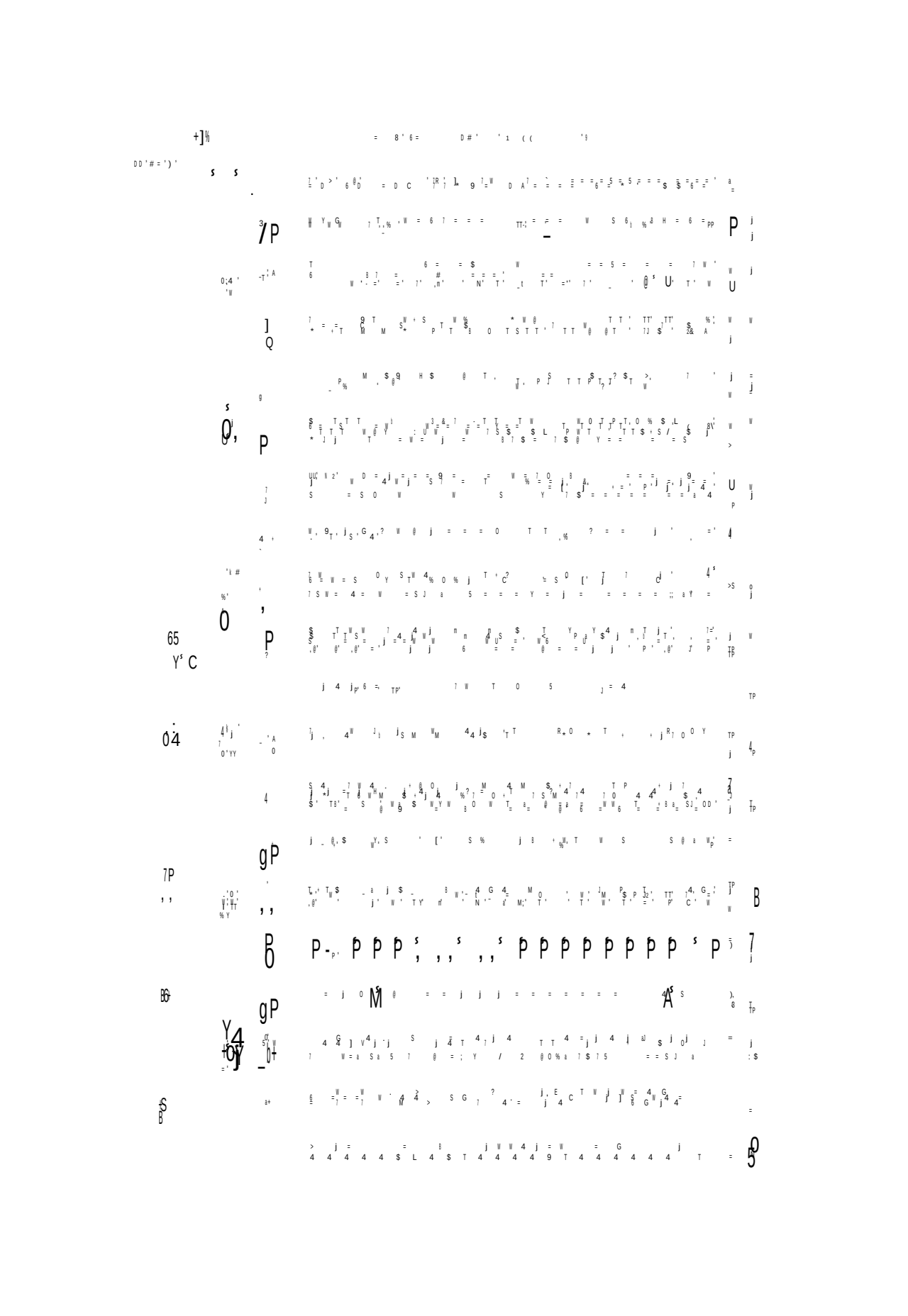

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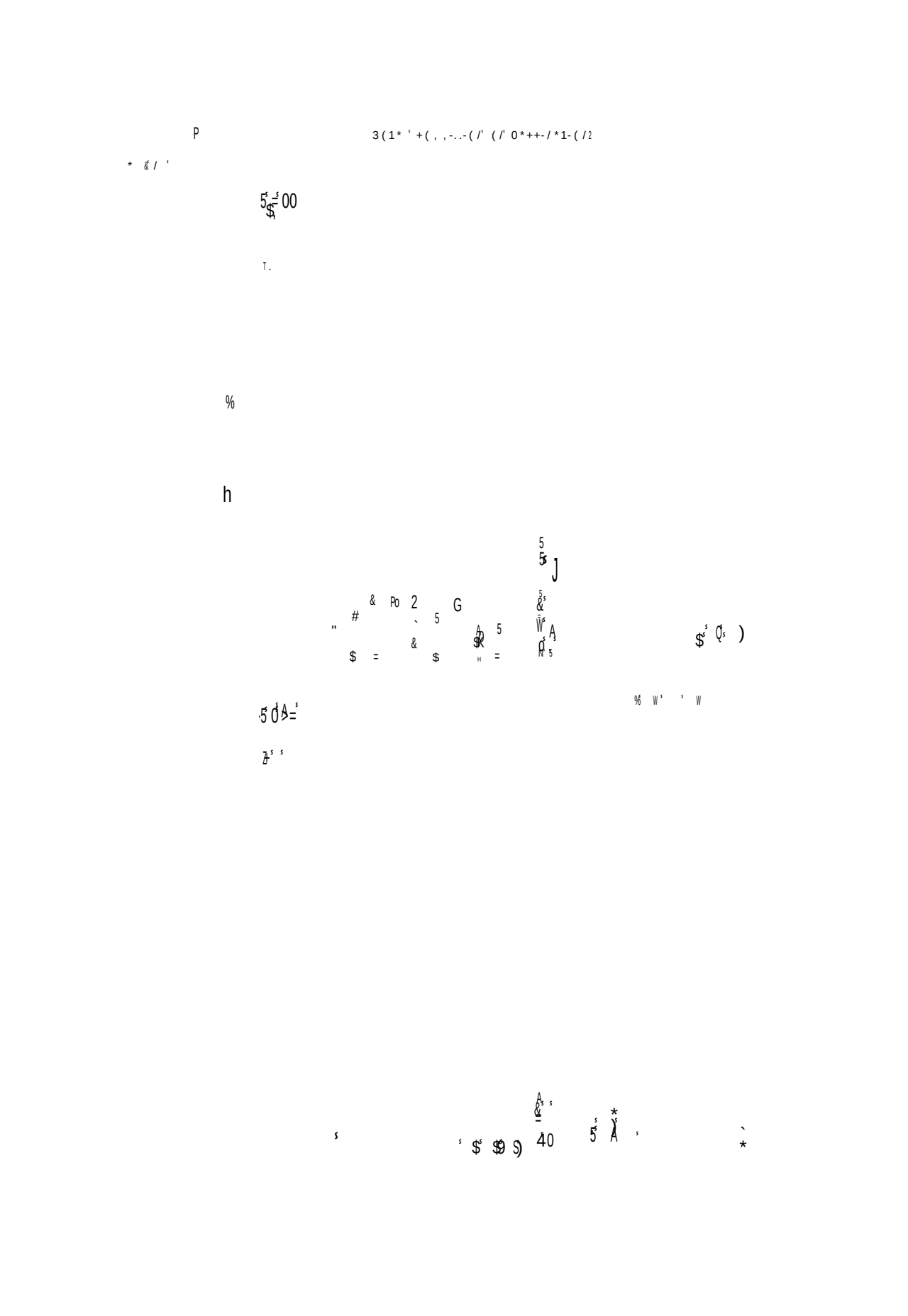

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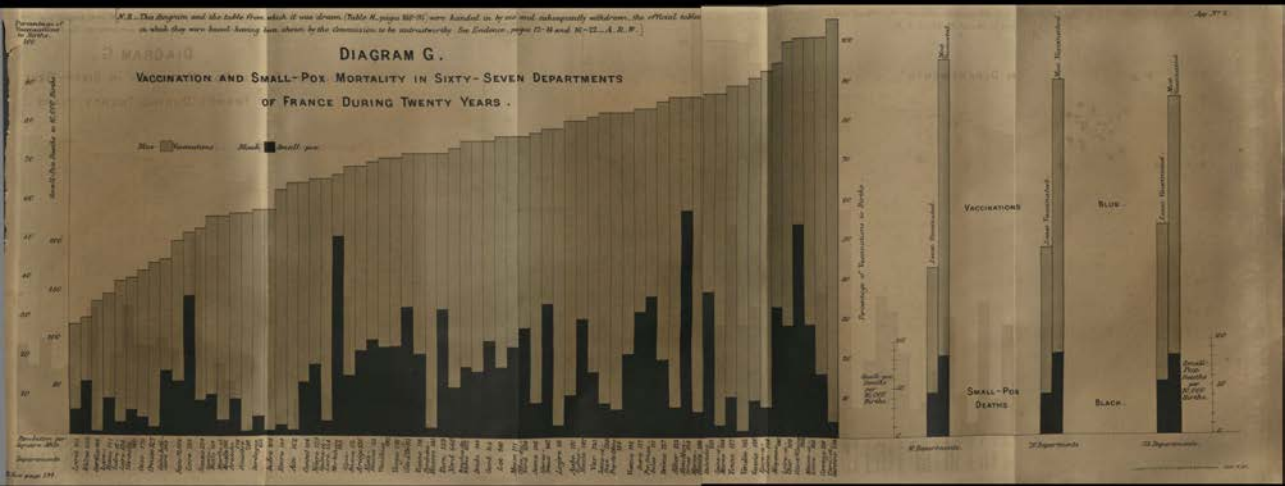

N.B.—This diagram and the table from which it was drawn (Table H, pages 160-161) were handed in by our mid-subsequently withdrawn, the official tables in which they were based having been shown by the Commission to be untrustworthy. See Evidence, pages 12-14 and 16-22.—A. R. W.
DIAGRAM G.
VACCINATION AND SMALL-POX MORTALITY IN SIXTY-SEVEN DEPARTMENTS OF FRANCE DURING TWENTY YEARS.
Blue Vaccinations
Black Small-pox
Percentage of Vaccinations in Births
Small-Pox Deaths per 10,000 Births
Vaccinations
Small-Pox Deaths
Blue
Black
Small-Pox Deaths per 10,000 Births

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67C	6G	888	6G
67H	6G 6C		HC
676	6GG C	7	G 8
677	6G 6C	(	8
678	6GC C	66	7
68	6GH	H 6	8
68	6G6 G	6 6	G6
68	6G7	CH7	
68G	6G8	G7	G
68	6	8 G	C7C
68C	6 8		
68H	6 7	G C 7	67
686	6 6	C	6
687	6 G H	G6	G
688	6 6		8
7	6 C H	8	G G
7	6 H GG	H	8C
7	6CG	C68	8
7 G	6H		6 7
7	66	H	7 C
7 C	67G	H7C	C
7 H	68H	C7	C
7 6	7 6	86	H 6
7 7	7 7	H8	G
7 8	7G	HG	
7	7 G	87	
7	7CH	6C	767
7	7H8	76	7
7 G	77	787	
7	787	HG7	6
7 C	8 C	6 C	68
7 H	8G	HCG	6
7 6	8 H	C	
7 7	8H		G
7 8	867	6 G	6
7	88C	68	68H
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7	6	H	C77
7 G		66	6
7	C8	MBg	H7
7 C	66	C)BCC	H
7 H	8G	C G	H
7 6		H H	CCC
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7 8	G	6GH	H
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7 8	G
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7C	7
7CG	8
7C	7
7CC	Q
7CH	
7C6	H
7C7	8
7C8	
7H	G
7H	7
7H	G
7HG	H8
7H	8
7HC	
7HH	H
7H6	
7H7	8
7H8	8
76	G
76	
76	C
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77	H
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77G	G
77	G
77C	GC
77H	
776	
777	

DIAGRAM J.

A CENTURY OF LONDON SMALL-POX: 1780 TO 1882.

[N.B. This diagram is the same as Diagram A., facing page 179, for the period of Official Registration (1852-82); but has been altered and rendered more accurate for the earlier period.

Authorities. The 8th Report of the Registrar-General for population within the Bills of Mortality from 1837 to 1853, and for the year 1838 (See page CXIII);

the intermediate years by interpolation.

The Annual Summary of Registrar-General for London 1882, Table 12, for Small-Pox Mortality per Million from 1853

The Annual Report of the Medical Officer of the Local Government Board for 1884 (Page 32) for Small-Pox deaths from 1780 to 1853

The Mortality per Million calculated by myself.—A. R. W.]

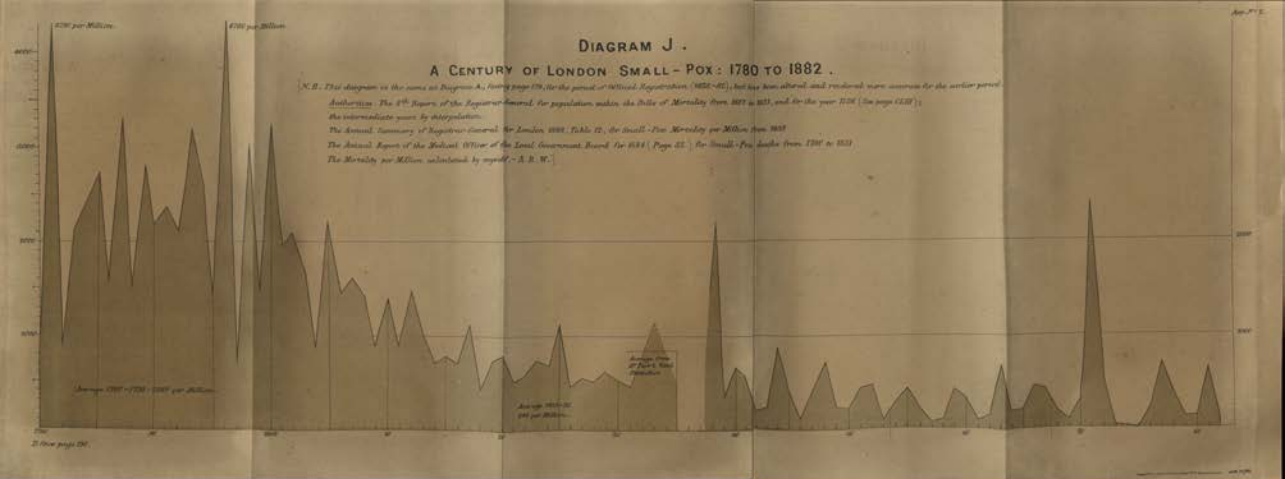

Diagram L.

PUBLIC VACCINATIONS IN ENGLAND PER HUNDRED THOUSAND OF THE POPULATION: INCLUDING RE-VACCINATIONS BY PUBLIC VACCINATORS.

Note. The lower line as given in my pamphlet on Vaccination does not include re-vaccinations: the upper line, from 1853 to 1886, is obtained from the figures in Table M-A.R.W.

To face page 187.

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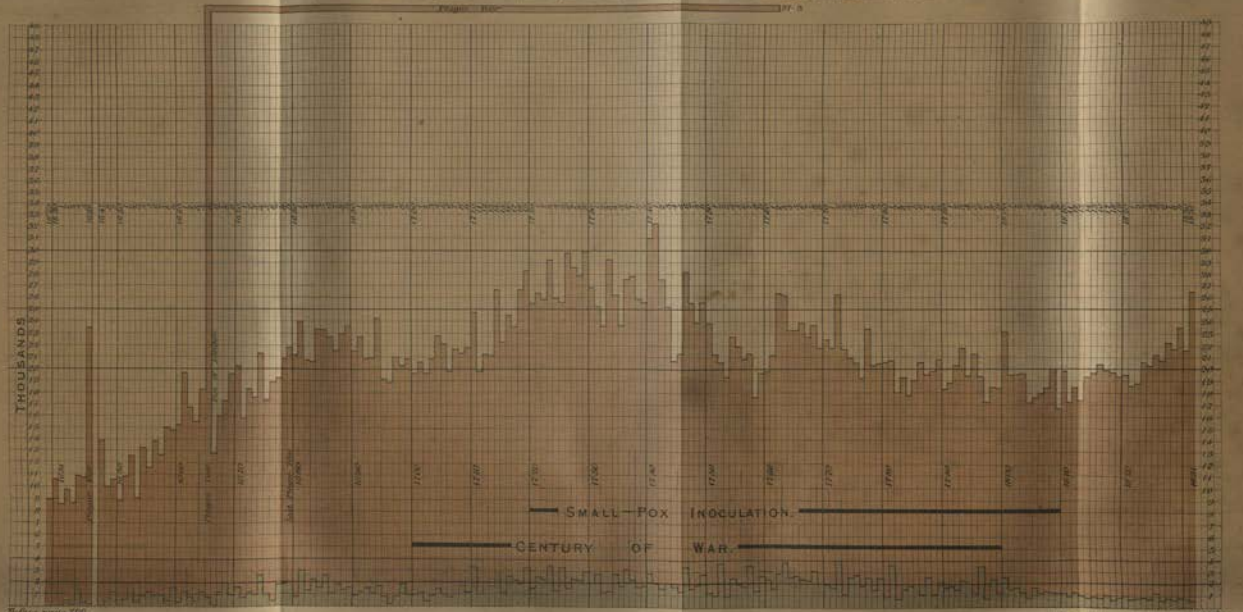
DIAGRAM A.

DIAGRAM SHOWING, FOR LONDON FOR EACH OF THE YEARS 1629-36 AND 1647-1831, THE NUMBER OF DEATHS FROM SMALL-POX AND FROM ALL CAUSES.

Blue Small-pox. Red All Causes.

(Compiled from "250 years of Small-pox in London" by William A. Guy, M.B., F.R.C.P., F.R.S.)



Refers page 116.

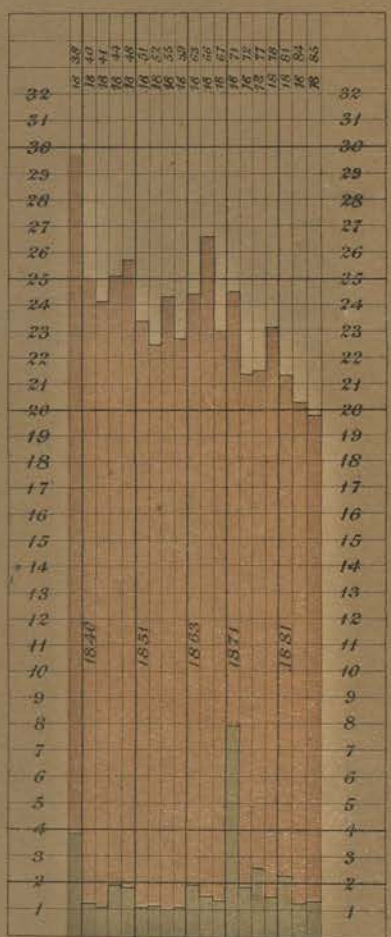
DIAGRAM B.

DIAGRAM SHOWING, FOR LONDON FOR CERTAIN SPECIFIED YEARS, THE NUMBER OF DEATHS FROM SMALL-POX AND THE DEATH-RATE FROM ALL CAUSES PER THOUSAND OF THE LIVING.

Blue ▭ *Actual number of Small-pox deaths in thousands.*

Red ▭ *Death-rate from All Causes per 1,000 of the living.*

[*Compiled from the Registrar-General's Reports.*]



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Judd & Co Lith. 73 & 75, Farringdon Rd & Doctors Commons. 1648. 10. 90

DIAGRAM C.

DIAGRAM SHOWING THE ANNUAL DEATH-RATE BY FEVERS IN LONDON PER HUNDRED THOUSAND LIVING AT SEVEN DIFFERENT PERIODS DURING THE YEARS 1629—1854.

[*The figures calculated from a table given on page 88 of the Appendix to the Commission's First Report.*]

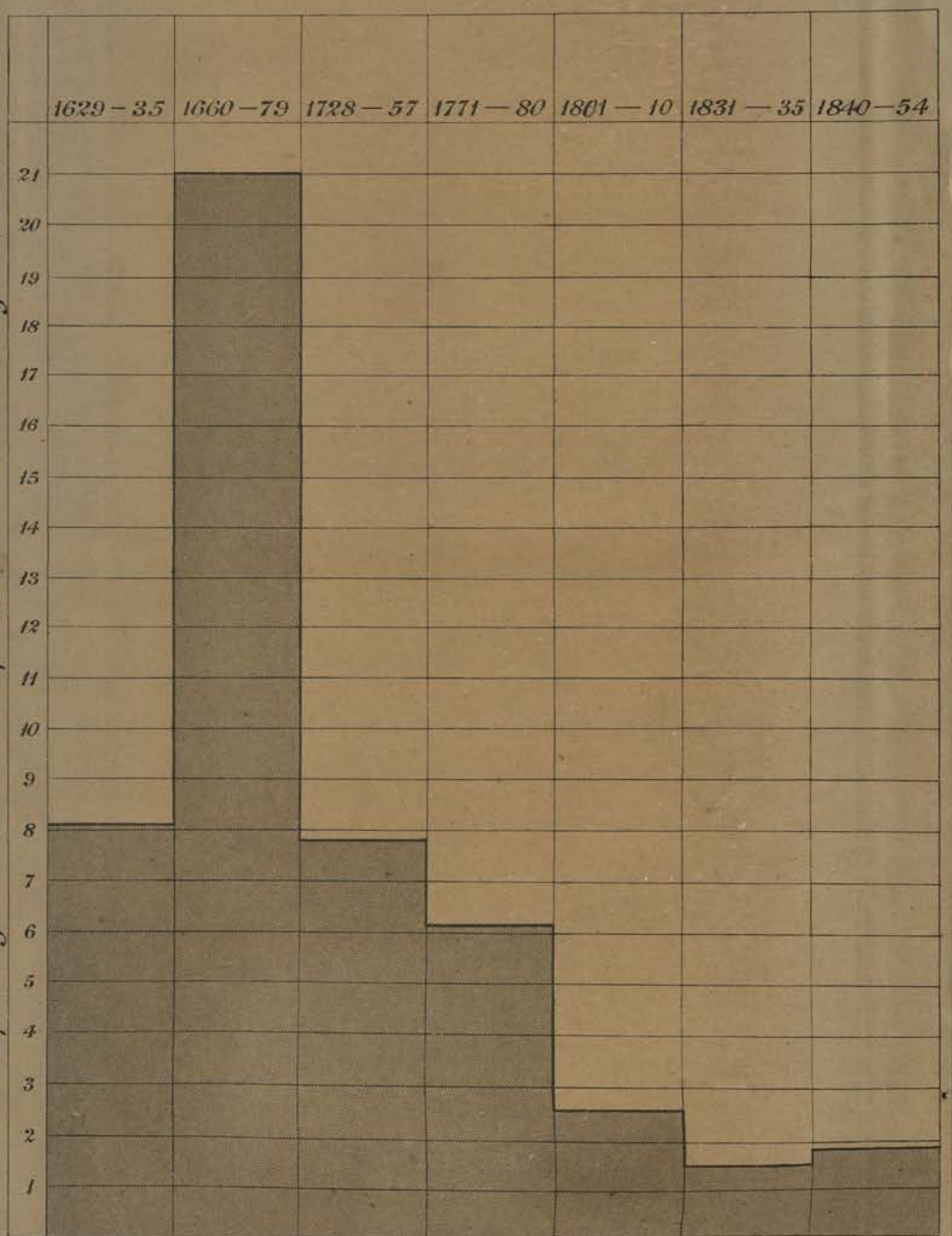

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Diagram F.

DIAGRAM SHOWING FOR ENGLAND AND WALES FOR EACH OF THE YEARS 1850-88, THE DEATH-RATE FROM SMALL-POX AND FROM ALL CAUSES PER MILLION OF THE LIVING, WITH THE NUMBER OF PUBLIC VACCINATIONS PER HUNDRED THOUSAND OF THE LIVING IN EACH OF THE YEARS 1852-87.

App. N° 3.

Blue = Small-pox. Red = All Causes.

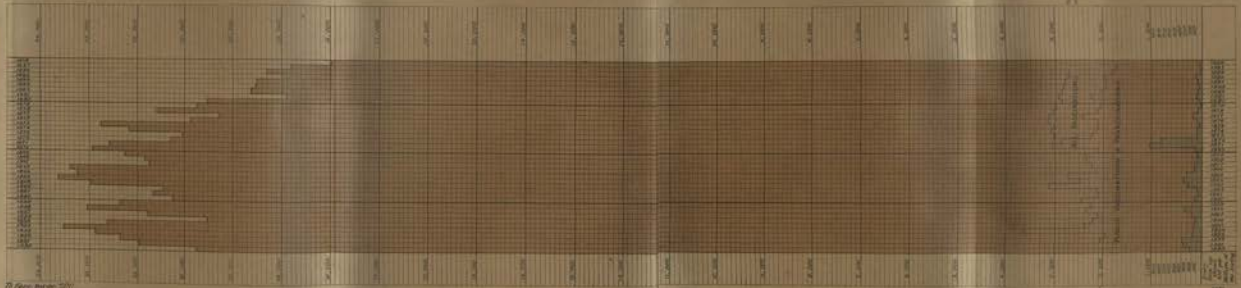


DIAGRAM G.

DIAGRAM SHOWING FOR ENGLAND AND WALES FOR EACH OF THE YEARS 1850-80, THE DEATH-RATE PER MILLION OF THE LIVING FROM ALL CAUSES DIVIDED ACCORDING TO Dr FARR'S CLASSIFICATION, WITH THE MEAN ANNUAL RATE FOR THE YEARS 1881-7.

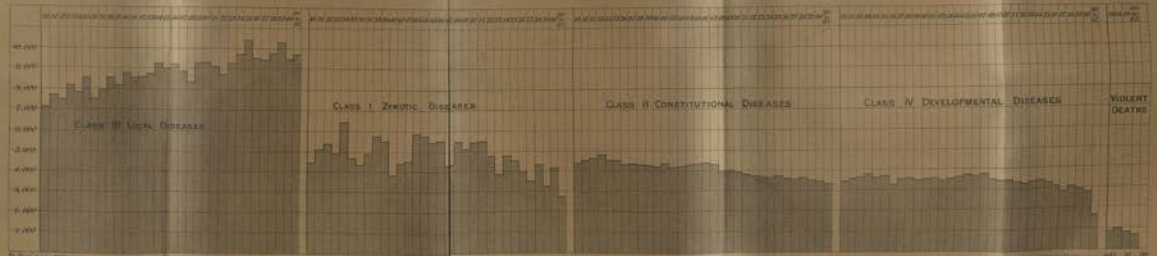
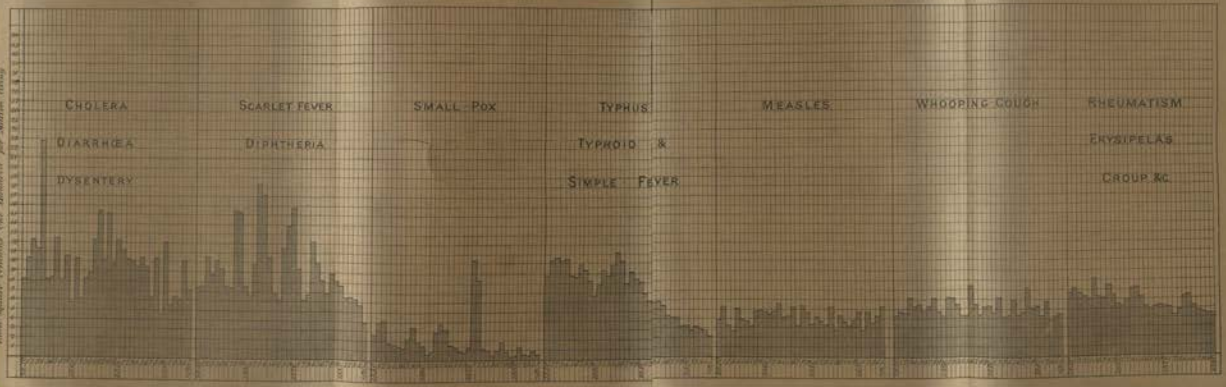


DIAGRAM H.

DIAGRAM SHOWING, FOR ENGLAND AND WALES FOR EACH OF THE YEARS 1850-84, THE DEATH-RATE PER MILLION OF THE LIVING FROM ZYMOTIC DISEASES DIVIDED INTO SEVEN CLASSES, WITH THE MEAN ANNUAL RATE FOR THE YEARS 1885-7.



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ˢ0 #1')ˢ ˢ$,' ˢ#!ˢ9 !2") ˢ#$ˢ% 0ˢ #ˢ# 0 0ˢ#$ˢ8! 27 !' ˢ $! ,ˢ * ,,29#@

! 5 >7F= 7 $5 L 57F L 57F ˢ7=ˢ$5 & 6 ?75A ˢ=Bˢ

U	8=?@=?ˢ =5 @ˢ=Bˢ % 5+7F ˢ 5 56F> 77 ˢ " D= 7ˢ	P-V P	2P	)TYQ
PV 2 2	8=?@=?ˢ 0G5++ D=Hˢ %= D 75+ˢ ˢ ˢ _	2- 2	P-2	) YQ
PV 2 V	+ 75 ˢ 06F==+ˢ=Bˢ N ??5ˢ N5?ˢ 0C 7 ?	VT		Y
PV 2	' F 5?ˢ $=++ A ˢ N ??5ˢ N5?ˢ 0C 7 ?	2P		QH
PV 2 2T	$ 7 ˢ %= D 75+ˢ N ??5ˢ ˢ N5?ˢ 0C 7 ?	PT		YQ
PV	&== ˢ %=> ˢ N ??5ˢ N5?ˢ 0C 7 ?ˢ ˢ	T		Y
PV	&5 G5? 5?ˢ %= D 75+ˢ N5?ˢ 0C 7 ?	2V		Y
Tˢ 5 Y	# > 75 77ˢ + 75 ˢ 65@ G ˢ ˢ N5?ˢ 0C 7 ?	)		YP
PV)	:> ?; ˢ + 7ˢ ?ˢ L>E ++5 @ˢ D5A ˢ PP)	PQ-T22	) Q2	P2Y
PV2	r> 6Fˢ 85G I 7ˢ L>E ++5 @ˢ D5A ˢ PP ˢ	V)	P	Q7
PVVVˢ 7=ˢ PQT)	# C65 7+ ˢ ,?B G5 ˢ =?7 7Fˢ ˢ ˢ	2	T	) Y2
PVV	" ˢ $ 6+=D(@ 5ˢ 7ˢ /ˢ ,?=6>+57 =?ˢ gˢ	TT	MB	PQYT
		)V-	-P2	PQYQ

ˢ

ˢ0 #1')ˢ ˢ$,' ˢ#!ˢ9 !2") ˢ#$ˢ% 0ˢ #ˢ" 0 0ˢ#$ˢ #0 27 !' ˢ4#09' ,ˢ * ,,29#@

' 5 %= D 75+ˢ 5?@ˢ >7F= 7 $5 N566 ?57 @ $5 L 57F L 57F ˢ7=ˢ$5 & 6 ?7 ˢ=Bˢ

ˢ /ˢ ˢ

PQT))	# C65 7+ =? ' ? ˢ K ? 5+ˢ L D ? 5 L =?7 7F	P-P Q		)T	PVY)
PQP PQ	%>@@ B +@ˢ K ? 5+ˢ ,?B G5 ˢ @ 65+ " D= 7=	Q			Y
PQ) VV	# C65 7+ =? ' ? ˢ K ? 5+ˢ ,?B G5 L =?7 7F	P-T	V	P)	Q
PQ 2 P	% AFA57 ˢ%= D 75+ˢ ˢ 5 =?ˢ	-2)	-T	P-P)	P Y V
PQ) 2V	% AFA57 ˢ%= D 75+ˢ 7 Fˢ @ 65+ˢ:=> ?5+- D5A P)P2ˢ) @ˢ :>? ˢ PQQ	V-)	V- T	QPT	Q
PQVQ	% AFA57 ˢ%= D 75+ˢ ˢ	Q			P Y)
PQVP V)	7=+ˢ F+ ˢ L=C? ˢ DF5?ˢ %=> - @ˢ " D= 7ˢ D5A	)	)	PQ	HQ
PQVV QP	,N 7ˢ %5Gˢ M? =?ˢ %= D 75+ˢ ˢ ˢ = - 8 " $ & ˢ /ˢ 85?6 7-gˢ))?@ˢ :>+ ˢ PQQ) ˢ		QQ	P2	P2Y
PQVT Q2	7 =D=+ 75? +>G ˢ =5 @ˢ %= D 75+ %5?@ L==1ˢ B= ˢ PQQVˢ D5A ˢ PT ˢ PT2ˢ	- V	P-T2P	V-2Q	P YP
PQVT P)	K+5 A=C ˢ %= D 75+ˢ L ˢ : ˢ ˢ "> ++- PQV	V)	2)	P T	P Y
PQV	L ˢ " 6 ˢ : ˢ 5H ?@ ++ˢ ˢ Uˢ	)T	P)	V	PQY
QV	7=ˢ 0G5++ D=Hˢ %= D 75+ˢ L ˢ L5E ˢ _		)		PPY
PQV2	7=ˢ 0G5++ D=Hˢ %= D 75+ˢ L ˢ L5E ˢ	PP			)VY)
PQVV	] ?F 5@ˢ ,O E ˢ 5?@ˢ M? =?ˢ %= D 75+ ˢ N56F ˢ 767	))	P V	P	P2Y
PQV2 VV	8 E D==+ˢ ++ˢ =5@ˢ %= D 75+ˢ L ˢ 6F		V P	P Q	P Y
PQQT	57Fˢ %= D 75+ˢ L ˢ 5I5f=?ˢ /ˢ 57F $E =? 6+ -g P 7Fˢ D ˢ PQQT	PQT	PT	Q	)TY
77 &7	"=6F@5+ ˢ %= D 75+ˢ L ˢ % ? ˢ " D= 7 7=ˢ % 5+7Fˢ $=GG 77	))	PV	)	Y
PQQP	# C65 7+ =? ' ? L ˢ G 7 =?Aˢ 5] ? =?ˢ D5A ˢ H	V)	V	V	YV
PQQ	# C65 7+ =? ' ? ˢ L ˢ G 7 =?Aˢ 5] ? =?ˢ D5A ˢ	)	P	V	P Y2
PQQ	K57 F 5@ =? ' ? ˢ L ˢ K ?ˢ @ 67ˢ	PVV	PPQ	T	P2Y

TV 8 $2 POOPT# # N $$,# ', #

DD #= Q

F=C ?A 7F B575+ 7 = D 6 ?75A = B @ 57F 7= 65 = B &= 7 : ?? 5 %= D 75+ 0G5++ D=H =? G @

! 5 %= D 75+ 5?@ >7F= 7 $5 N566 ?57 @ $5 L 57F & 6 ?75A = B L 57F 7= $5

PQQ)	5?6F 7 => 5++ % '=G] ?	P Q	P)	)	P2 V
PQQ	S S S	2			P YQ
PQQ	S - S	P			))YV
PQQ	Z Z L 05+6=? + @	))	P T		P ;Y
PQQ	5?6F 7 28 G5 5?6F 7 T	TP	) V		PTW
PQQ	'5>?7=? %= D 75+ L +B= @ / * 7 ?	))	-	Q	PV
PQQ	'F $=>?7 +>G @B= @ L	2	2	P	) Y
PQQ	0C5 ?7 85?6 7 V7F 5 6F PQQ	P- P	P- Q	PT)	2Y
PQV Q)	G ?AF5G * M 8 ? 5?@ F M	22	2	PP2	PV
PQQ	0F BB +@ %= D 75+ L * ++ @ 67	)T	P	)P	+ 0
PQQV QQ	0F BB +@ %= D 75+ L 5 (D= 7 =?	P-V Q	P- P	) 2	P Y)
PQQV	@@+ I =>AF L - 5+6=G =?- @ 67	PW	P2T	P	Qa
PQQQ	= &5] L>6] & 7=? L &] ?A	PW	P T	P)	2 Q
#= @57	07 &5?6 5 K A= => \> 7 D5A 2	)-)PV	VQ		)2YQ
PQQ Q	* %5G = / 7 F @ 65	P- P	& [d	)QT	PQY
	:=> ?5+ g)27F 0 I >5 PQW		b @ 4 & 4 W		

+> 0%

PQVQ	%5 @C 6] 07 7 L>I+ ? " D= 7	PP	VW	))	P
PQV2 QT	$=] 07 7 L>I+ ? " D= 7 D5A QV	)- T	P- 2	)	)PaV

= , * ((/ 6 $ Q2- P 2)-QQV P)-V T P ;V

+

PQ)	0D 6 5 0G5++ D=H %= D 75+ $=D ?F5A ?	P)	) V		
PQ)	'F 5G	2)	Q		
PQ)	'F 5G	P-T	Q Q		
PQ	'F 5G	P-P V	P-T	PT2	QYQ
PQ V 2	N ?25 K ? 5 %= D 75+ L % I 5	2-)P	-)PV	VP	aP
PQ V 2	& 0 G=? K ? 5 %= D 75+ L % I 5	QV)	QP	2	
PQ V 2	& 5A> %= D 75+ =7F =B 6 L	PT	VT		
PQ 2	& 5A> 0 5?6 = B $F +@ ?; %= D 75+	)2	V		PP
PQ P 2	& 5A> (+ 15I 7F5? %= D 75+ L % I 5	PPQ	PTQ		)Y
PQ)	. + %= D 75+ L % I 5 0 G=?	)PQ	P)	T	PY
PQ2Q 2Q	+A 5? G %= D 75+ @ ?=	PV	PPVY	PP	2Y
QVT V	'F 5G	P-)2	2 VY	PPT	QY)
PQV2 V	'F 5G	Q)T	P2	P	Y
PQ2 VT	= @ 5>H (@D 75+ 07 2@ , 5+5@	Q	VP	)V	)VYT
PQ2 VT	= @ 5>H %@D 75+ 5+5@		V		Y
PQ2 VT	%B D 75+ @ 5 75?6 &>I+ \> &5	P-2 P		TQ	PQY)
PQ2 VT	%@D 75+ $F5 7 &5 ? PQV)	P	,++Y		P)Y
PQ2 VT	%27 L >8 =? ? PQV)	)2	P		P Y
PQVT	%@D 75 M75 ? PQV)	P Q		PT	Y

#= 7 5+ A E ?

)T

)'# ' [< 4 &

' F=C ?A'7F 'B575+ 7 -' = 'D ;Y6 ?75A '=B'@ 57F '7='65 -'=B'&= 7 : ?? 5?'& = D 75+'OG5++ D=H [4 & * &' / 'G

) M ' '* + 0 + B ! &+ % ' ;'B

76 &6 , '* '! 'B ': K ' & C □ □CH 7□ H&H

76 &6 , 'M ': '! 'B '+ 6 C67 <' G 8 6□ □& 6

J' 'O a' % 'CG'CH

76G&6□ * 'B 'o 'J') = a 77 < CH G &

% ' ' 767

76 '* M =' 'M ' '! ' : H < 7□ 6&G

76

76 ', 1 ' '& & & & & □C < H 6&7

76 ' 1 ' '& & & & & 6 8 < 77 H&p

76 ' 1 ' '& & & & & □C8 < GG□ Q7

76 '* % 1 ' '& & & & & 8□ < 6 &6

76 '. 1 ' '& & & & & 8C < &

76 'Q M '0 ' 'c ' : ' 76 8G □ □&

76 M ', ' '0 ' : □ 8 7&8

76 ' U

76 , ' B 'c ' : ' 76 ' & H7 < 7 H' H

7 C ! 'M '! ' : K Q' & C7□ c(8H CMHY

7 C + 'M ' ', ' : K 76 H7 6 &□

7 6 + % '/ 'M ', ' : & 877 HC8 □H □&H

K

7G . 'M ', ' : K 6□7 H □ □C 8

7GG . %'M ', ' : K ' & 86 C □ □Q□

7G7&G8 B L 'M ', ' : K '& □8 H < <

7G8 . &, '- ' : K

77 MH 'B '! ' : K □ □□ 7 7&C

' .') < 2 G□ 76G C 87 □ G7G &C

! (" 0

7 G& □ ! ' M ' #' GC H□ 8 6"

9 '/ ' CG' 7H ' %' +(

7□ &6 ! 'M 0 # B '> ' 76 '& □66 <

76 ! 'M # B '> ' 76 '& 78 688 G7 G Q

76 ! 'M # B '> ' 76 '& G6 7G G□ G &

76G ! 'M # B '> ' 76 '& GH 7 8 C&

76□ ! 'M # B '> ' 76 '& H 7 C G & C

76C ! 'M # B '> ' 76 '& □H G 6 GC&□

7C8&H : ' M # , ' 9 86 G □ □&□

/ ' CG' 7H ' %' H

766 . '! 'B ', 6H G□ □C 7&

77 + %'M #9 & ;' B 6 < G H G Q

;'M ' % ' G& □

77 + %'M #E9 ' ;' B CC < 7 H&

;'M ' % ' □

77 / ') Y' 9 ' M #J' / HH 7H □7 7&7

) Y M a

77□&7C , ' M #B '1 Y 'J & GG C 6 □ 7 G &G

H ' , ' 77

' .' ! (8 6 HG6 C88 H&7

. , *9)

$ g' ((g' ' 7H □ □ H 776 6G □&6

' "' 2' "' 2 G□ 76G C 87 □ G7G &C

! ('2 2 2 2 2 8 H6 H76 C88 H&7

' :'2 G 8C6 7 C C 8 6 C&

Q' 7 G&□&C' J'$ +WF 'J+M '7=?7 ',;(> =D ' ' ' D @ G 6 'W+' N5?=+ ; [< 4HUG 4' R' g'56C 7 6+

"' H ' ' '<

)T " ! 8 $,00, # # N $$+,# ', #

* ' / '7

' 0"

' 8(F=C ?A'7F '#>GI ' =5' @G =? '52@' L 57F '57'7F '0, E '52@' 0G5++ D=H' %= D 75+ ' =5' 7F ' 7 =D=+ 75?'
+>G' '=5 @'- @> ?A'7F 5 ' PQVT Q2

L '4 '/'+ & P'g' '4 '/ &' '4 ' ' PQQV'-# * ' %' PT ' &' PT2 e' _

. A& = !

! B " , ' ' '

1 & ! (; ! &
M , ' & '= 0 ? '4 & ? ; '0 ? 0' ? A & ; 00, 0 & ? 0 ? 1 & ? ; '0 ? ? B
:'

76															76
76 '_	G 8 H	868	8 H		86							G 86H	' 6		76
76												7	C6		76
76G	6□	H	C7		G								C		76G
76□		□G	H	#	#	0 G7□Q	&	8Q7	GQH			886	□G		76□
76 C	78	HC	□									7 C	G 7		76H
76H	8	8C8	GG		8							□C7	Q□7		76H
766															766
76G 'N	H7□	8 6G	C		76□							CHC	67		767
768												G	G 7		768
77	6	□G	□ 7	68	CB	C	□C					C C	G 8		77
77	7 6 8	H 8C	□ 7	H	□H	HGC	G □		□ &□	G QC		G□6	GGG		77
77	7□G	□ H	7	88		7C	H6	7				78G	G7		77
77G	HGG	□7□	8G	CH	G□	□	7					6□C	G7□		77G
77□	H C77	C □	66□	G68	GH	□	□	7Q 7	□8&	G Q 8	B)gM	G8			77□
77C	H G8	□ 8CG	7 6	HG	□	□ 6	□	6&6	C Q 8	G QC□	7H		7		77C
77H	G□	7	G	G		6	C	8&8	□GQ6	6Q7	6		H		77H

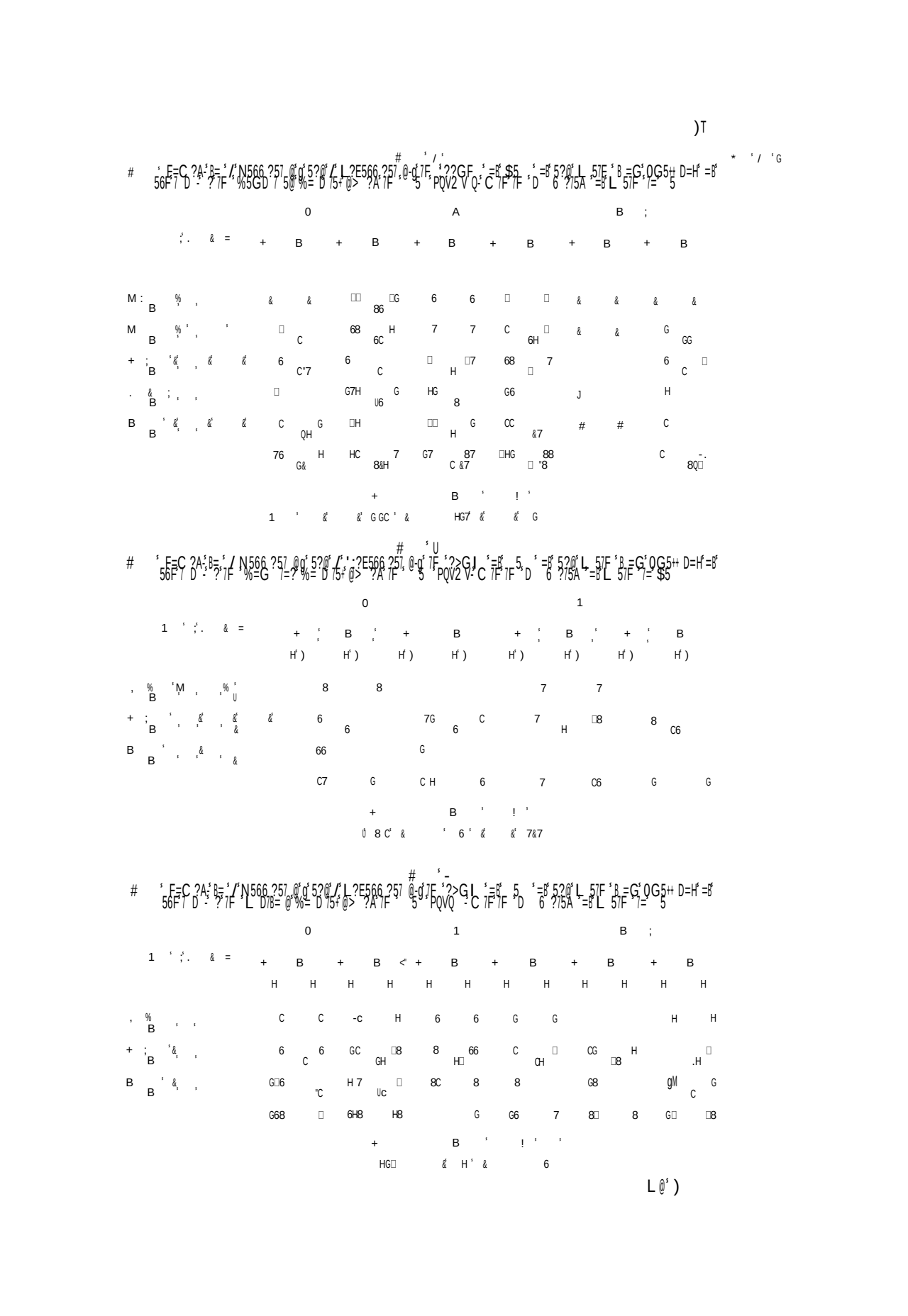
1	CG H68Q	□ H Q	8 H 6Q	7C7Q	G C86Q	G 8 Q	786Q	7"6Q	G Q Q	7 QGQ		
					6 C7C	□ ' '						

$. 4 &'J ' # ' ' A

' "

' F=C ?A'-R=' 56F=' 7F ' L 5 ' PQV 0 '-7F '#>GI ' =5' L 56 G57 =? '-=5' (E56= ?57 =? '-5?@' =5' 7756] ' =5'
5?@' L 57F ' B' =G' 0G5++ D=H' ? 0 5?6 '-7=A'7F C 7F'7F D 6 ?75A' =5' ! 566 ?57 =? ' 7= 7F
:@ ' > %4)' [# 4' 'F 4)' PQQ '-# * ' e

)	0	: &	* Y ' ' . & =	B ' ; ' . A& =	0 ' ' :
76C	CC□ 66G	G 6	□ G	H87	H8Q H
76H	CC7 7CC	H □CG	6	H7	66Q8□
766	C67 8H8	□ 77G	8 C	HH	6□Q7H
767	H □ 7	7 6G□	□ 7	7 G	6CQC8' &
768	C77 G□7	7 C	7 □67	G	6H& H
77	HC7 876	□8 7□	6 C68	886	78Q
77	HG	8 68	□ G	G □G	7GQ78
77	H C 7	G□ 8□8	G□ 6□H	86	7 Q76
77G	□H 7 G	□C C 7	H C	C 6	78Q C
77□	H76 6H	7 7 6	7 8	□	7 &C7
77H	H 8	G 88	7 8□7	6 6	7 Q8
' 76C&7C	H □GH C 7	6 C8	GG 78□	P HQC' ' ' ;' Y _	68Q7



BTM

DD$ #=$

$ F=C ?A$7F $B575+ 7 $B =G$ L 6 7 -$ $=?B+> ?7-$ 5 ? @ $ 5+ A?5?7 0G5++ D=H

	+ 5	%= D 75+$5?@$ = 7$=B$+5 B 657 =?	$5	L 57F	$5	L 57F	$5	L 57F
					$=?B+> ?7		5+ A?5?7 [	
	PQ 2 P	% AFA57 $ J ,5 =? -/>?D =7 67 @g$	)T)	Q	)-)	QQ		
	PQV2 V Q	%5GD 7 5@$ J ?AF5G -$ /> E566	3		2)P	)VQ	P)V	PP
M?E566 ?57 @-$ 65 KS	PQVV Q	O>+F5G$ J 5]>?5 -$ >?E5 6 ?57 @g$	VQ		)	P		
	PQVQ V	L D7B= @$ J 6$=GI -$ >?E566 $ 57 @ T	PT	)T	P	P	PT	PT
	PQQ $ _	# C65 7+ $ J G 7 =?A -$ />?E566 Y$?57 @ Y	V	T		PQ		/
			T	QV/D $6 ?7 =B57756] $	-2P2	P- T B)D 6 ?7 =B57756] e	PQP	P2 B TD 6 ?7 =B57756] e
$5 $/$ 5 @	PQ 2 P	% AFA57 - $ 5 @$7=$I g	2P	,	) T	V2		
	PQV2 V Q	%5GD 7 5@-$/$F5@g $ $	))	P P	2T	2Q		V
	PQVV Q	O>+F5G-$/$7 56 $=B$E566 ?57 =?$G5] $g	Q	P P	2	P	PT	PT
		?57 @ g		$?2$D $6 ?7 $=B57756] e	2	P))D $6 ?7 =B57756] e	2V	V dQ$D 6 ?7- =B57756] e
/$L=>I7B>+$g$-$ 65	PQV2 V Q	%5GD 7 5@$	P	T		P2		P
	PQVQ V	L D7B= @$ $ $ $ $ _	2		P)	22	Q	Q
8	PQQ $	# C65 7+ $		T	P			
		$=75+$=B$/$@=>I7B>+g=5	PP2	d $D $6 ?7 =B57756] e	PV	d)D $6 ?7 =B57756] e	PP	#)+I7 7 7 / =B57756] e
	PQ 2 P	% AFA57 - $?@ BB ?7$g	V	$ P	2	?=		
	PQV2 V Wa	%5GD 7 5@-$/$G=@ 57 $g	P	T	)2	2	T	
?@ BB ?7 E566 ?57 =? G5] g	PQVV Q	O>+F5G- $?@ BB ?7g	QT	T	) 2	2P	)2	PQ
	PQVQ V	L D7B= @-$/$?@ BB ?7$g	2P	,	PQ	T	PP	PP
	PQQ $ _	# C65 7+ -$/$?@ BB ?7$g		T	2	_		
		$=75+$=B65 $C 7F $?@ BB ?7 E566 ?57 =?$G5] g	)-T)Q	B QD $6 ?7 =B57756] e	P- Q2	PVD) $6 ?7 + =B57756] e	P _ QV	V Q $D 6 ?7 =B57756] e
	PQ 2 P	% AFA57	Q 2		P	V2	&	U
	PQV2 V	%5GD 7 5@$	Q)		VQ	)2	QT	)
K==@$E566 ?5^ 7 =?$G5]	PQVV Q T	O>+F5G$	))	T	T			
	PQVQ $	L D7B= @$	2	)	)V	2	PT	PT
	PQQ $ _	# C65 7+ $	Q	T	)			
		$=75+$=B65 $C 7F$ A==@$E566 ^ ?57 =?$G5]	)-T P	d $D 6 ?7 =B57756] e	P- T	PP2 dQ$D 6 ?7 =B5 756] e	T	dQ D 6 7 =B57756] e

)TQ (! 8 $,00, # # N $$,# ', #

DD #=

F=C ?A;7F B575+ 7 =B%= D 75+ 0G5++ D=H5G=?A D =? F5E ?A =? 7C= = 7F = B=> A==@
E566 ?57 =? G5]

#= =B N566 ?57 =? 5]

%= D 75+)

	$5	L 57F D 6 ?7	$5	L 57F D 6 ?7	$5	L 57F D 6 ?7	$5	L 57F D 6 ?7
/ N5+> =B N566 ?57 =? g [L K5 7=?	)	aP	2	Q a	PQ	)Y	Q	P
%5GD 7 5@ POV2 V Q	P Q		)22	Y	)	g ?^	)))	aP
L D7B= @ POV	V	PY	P V	P	VV	P Q	V	) V
%=G 7=> 5?@ 07=6]C ++ PQV P)	2)		2V	P	TP	)	)	P P
O>+F5G PQVV Q	QP		2	TY	2	P		T
# C65 7+ PQQ	2	P2a2	)	TY	)	Q V		Ta
5 =? PQ 2 P	V2Q	Y)	2TQ	) a2Q	PQV	PY2	)T)	
		P)		T				)T-
	)-)Q		)- 2	2	P-)	YP	P-) Q	PY2
0 ?A+ E566 ?57 =? G5] 65 Z Z @ 57F	)-)Q							
		P)						
>+7 D+ E566 ?57 =? G5] - a 65 Z Z Z @ 57F			-P)2					
				P				

# #

, * / / g " = / 1 / $ 1 2 *

L 5

67?5+ 5? =B 5 PQ2P PQVT 0>DD+ G ?7 7= 7F D= 7 =B A 7 5 K ? 5+ &5A $ 5 + PT= =7F 0 H & ++ =?-8 E I= ?

K E ? HD 6757 =? B= PQQP PQQV 5? ?>>58

67>5+ G 5? 5??>5+ L 57F PQQP PQQV T

0G5++ D=H 5 +	- P	)- V2	V
065 +57 ?5	PP- TV	PT-)QP	PT-
+ DF7F 5	PV-	P2-T 2	2-)
F> GD+ 5?@ ?7 6 B E	)-)	)-P22	)-) 2
	2- TP	-Q)	V P

# #

F=C ?A B= 7F D =@ PQQP V 7F L 57F B =G 0G5++ D=H 5?@ B =G ' DF> 0 GD+ 5?@ (?7 6 & E 5-
57 5++ A ? E 5+ '=C?

'=C? $5> =B L 57F

		L 0 5 ??>5+ 5? B= PQ2P PQVT	K E ? HD 6757 =? =? &=D>+57 =? =B PQQP PQQV	67?5+ 5? ??>5+ L 57F PQQP PQQV	N566 ?57 =? >?566=>?7 @ B= D 6 ?7 =B 7F PQVQ PQVV
L5 7B=7@		0G5++ D=H DF> GD+ 5?@ ?7 6 B E	V)	PP P) -	B [
0F BB +@		0G5++ D=H DF> GD+ 5?@ ?7 6 B E	Q)T)	P))	V [
G ?AF5G S	V	0G5++ D=H DF> GD+ 5?@ ?7 6 B E 5	Q PV	) P	)	2 [
& 7=? W	V	0G5++ D=H DF> GD+ 5?@ ?7 6 B E	Q PT	P)T	P 22	[
8 6 7	V	0G5++ D=H DF> GD+ 5?@ ?7 6 B E U	Q 2	P 2	T)2	2 [
. AF+	V	0G5++ D=H DF> GD+ 5?@ ?7 6 B E	P)	P 2	T P	V [
K+6>6 7	V Y	0G5++ D=H DF> GD+ 5?@ ?7 6 B E	)	Rg	T PP	(

&&(#L,<-)T

DD- ‘#=‘

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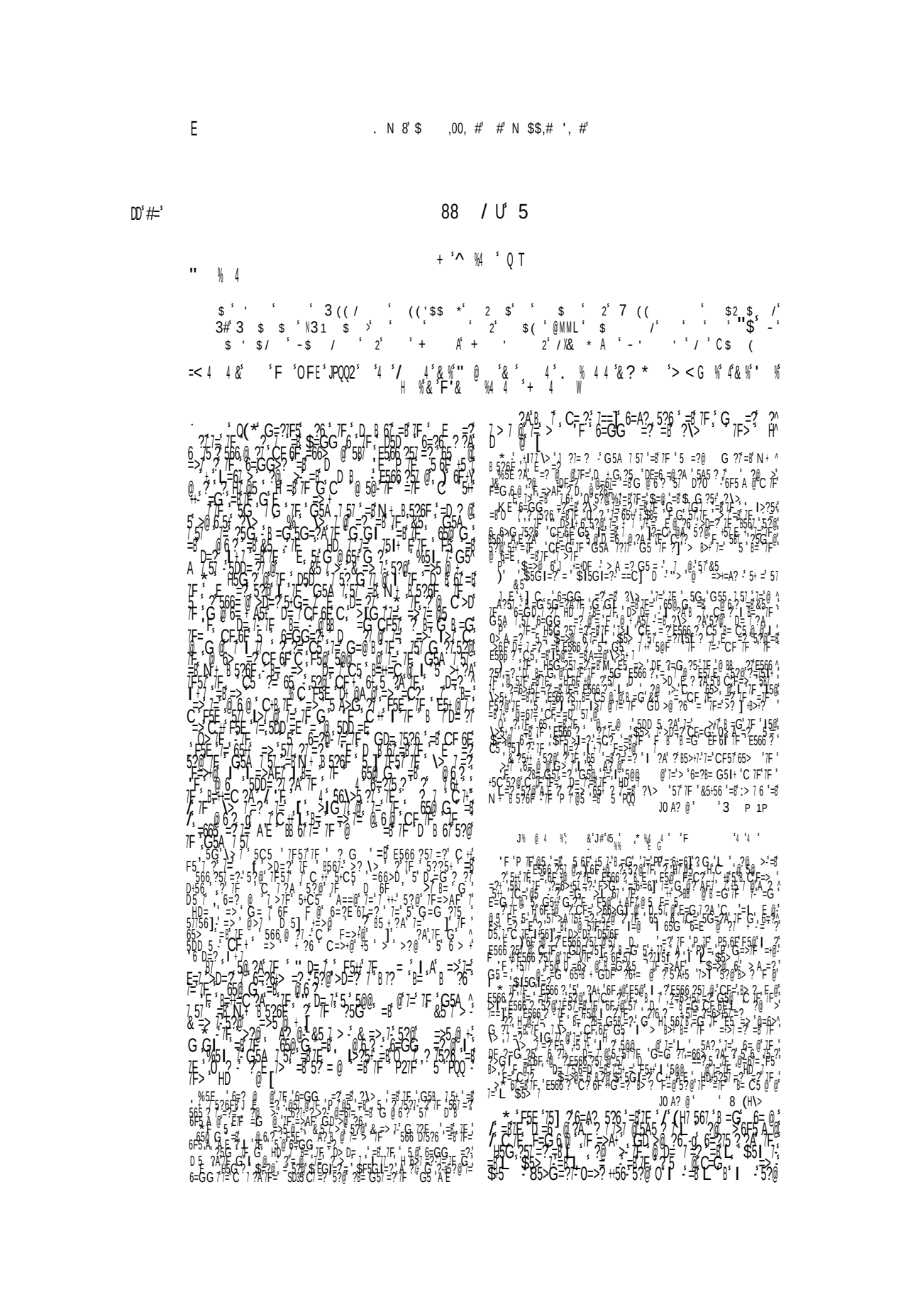

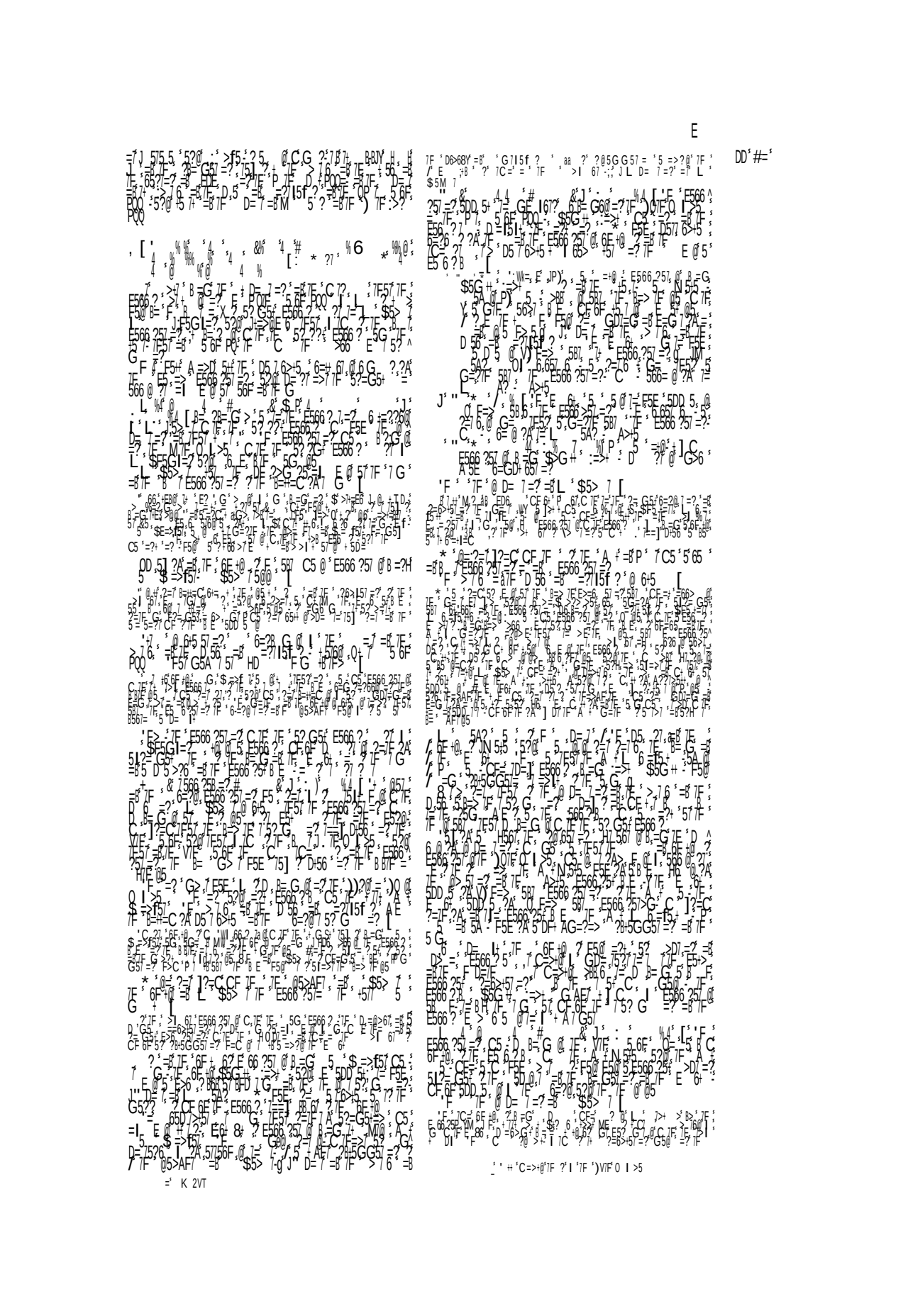

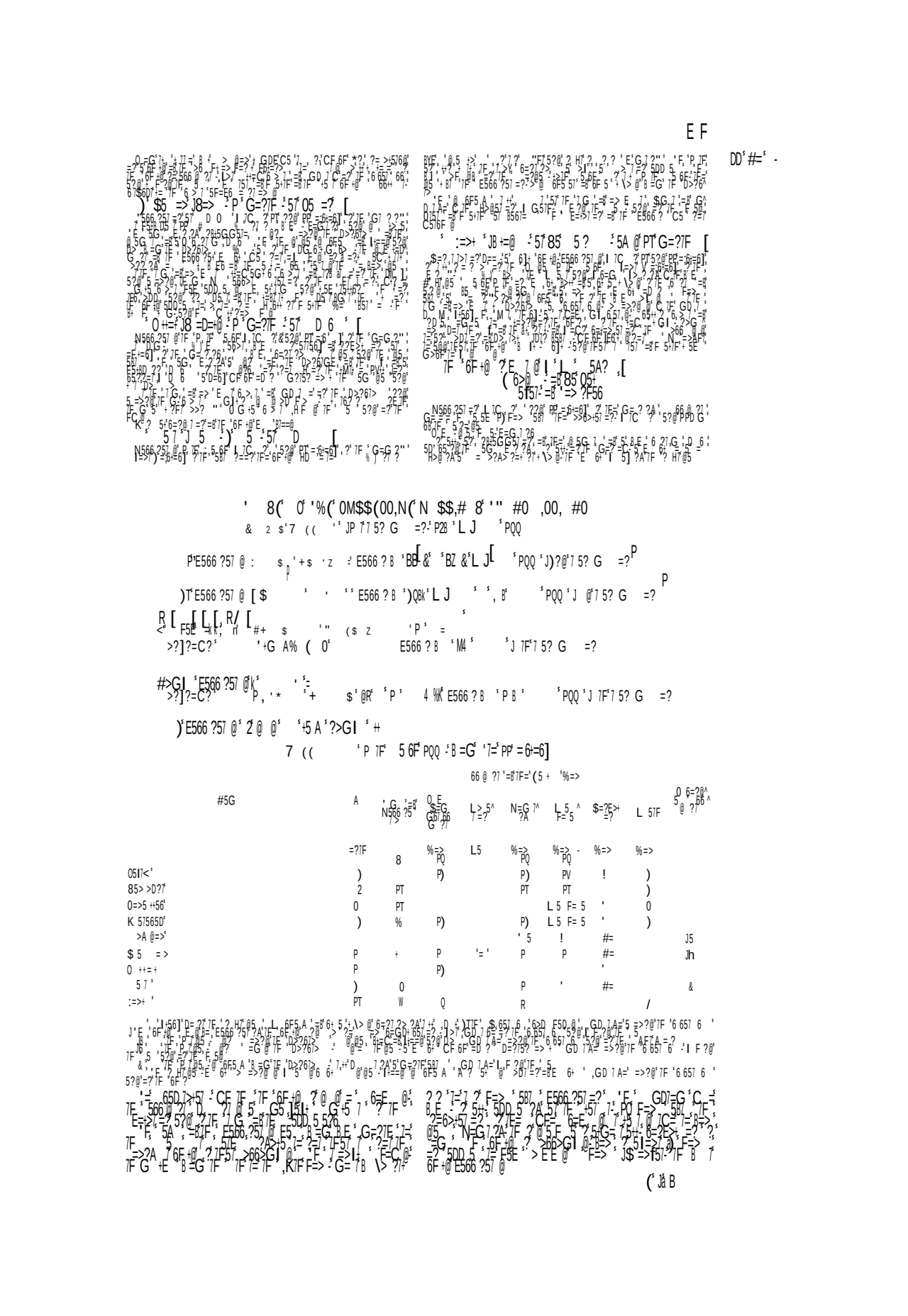

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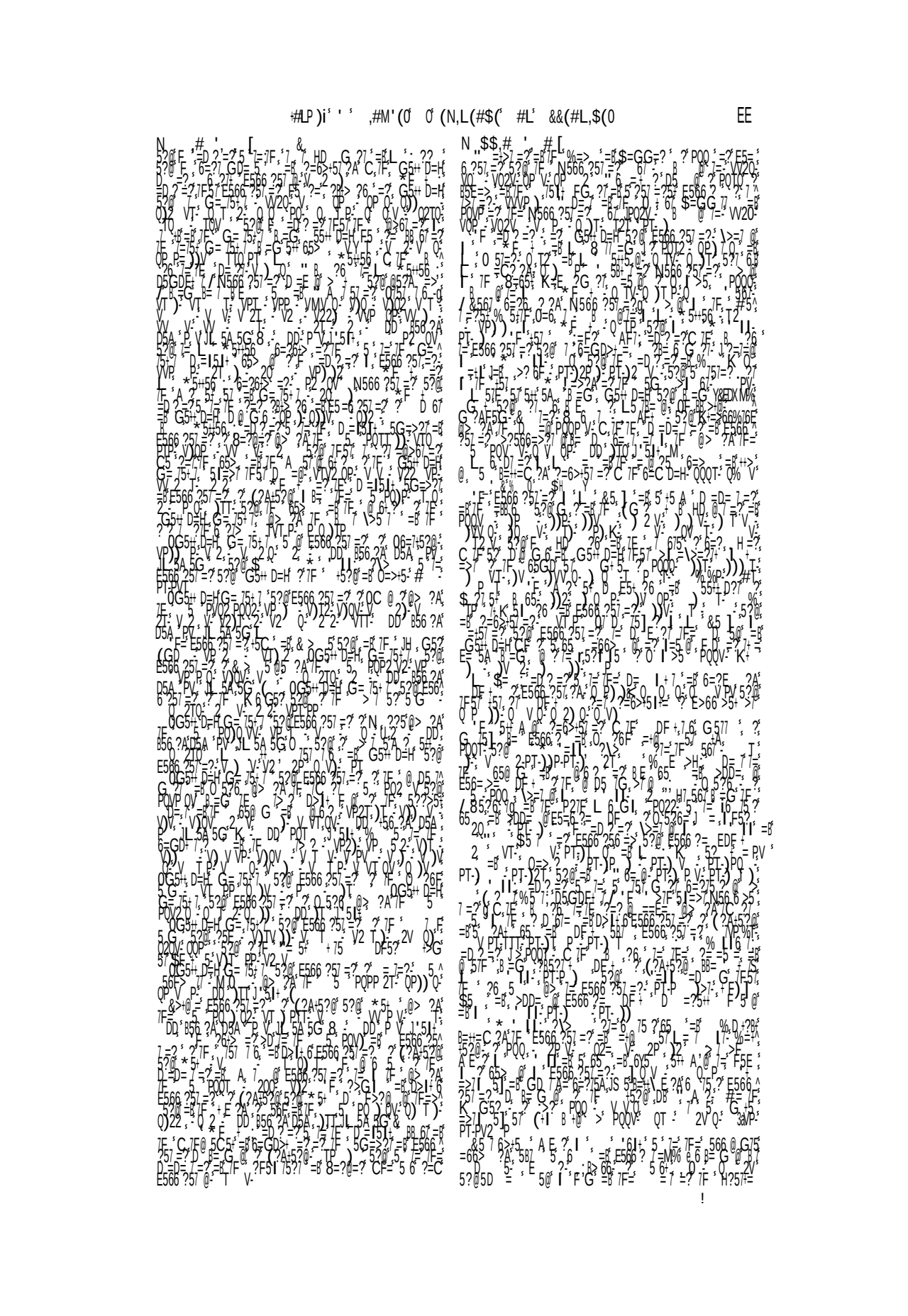

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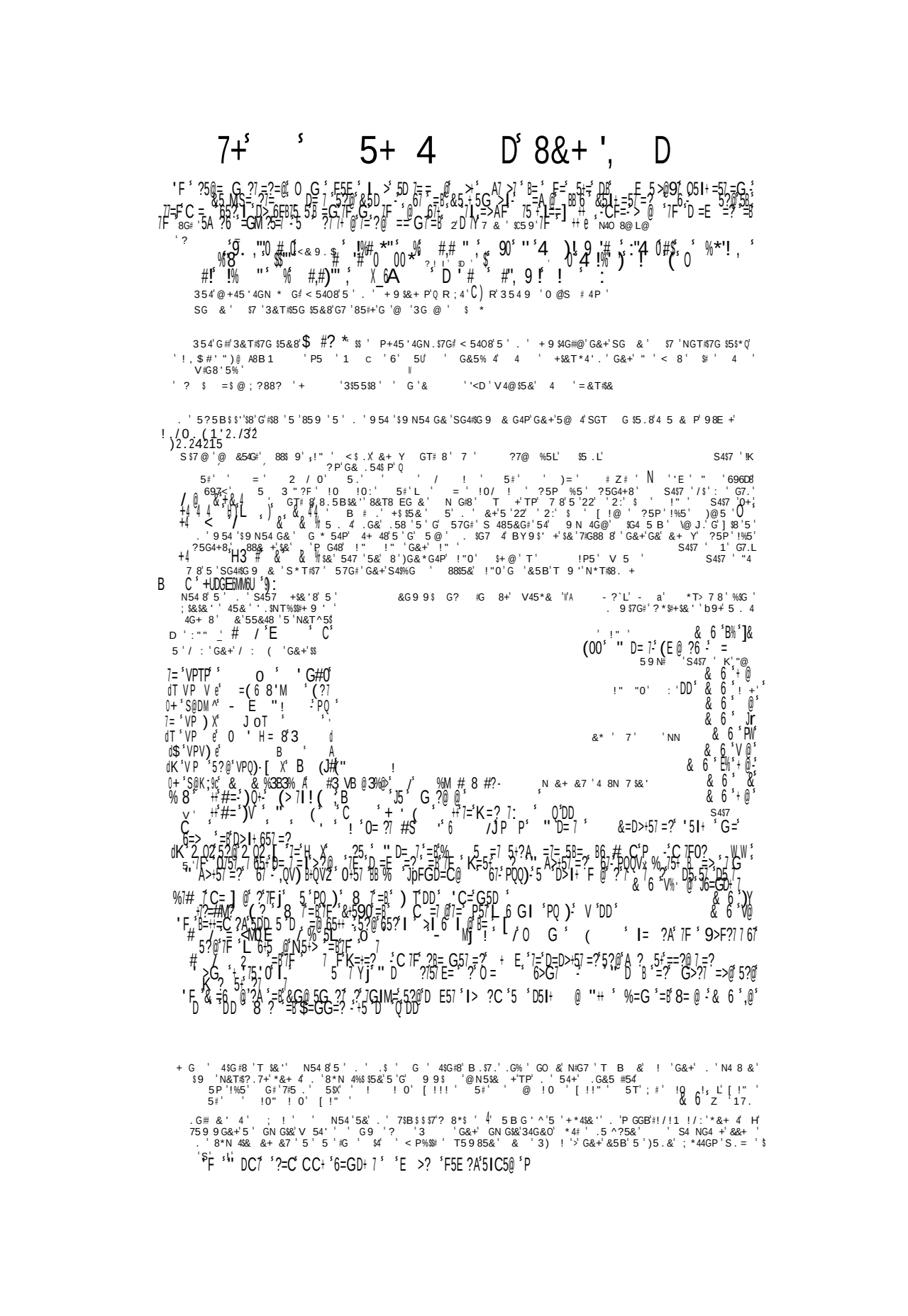

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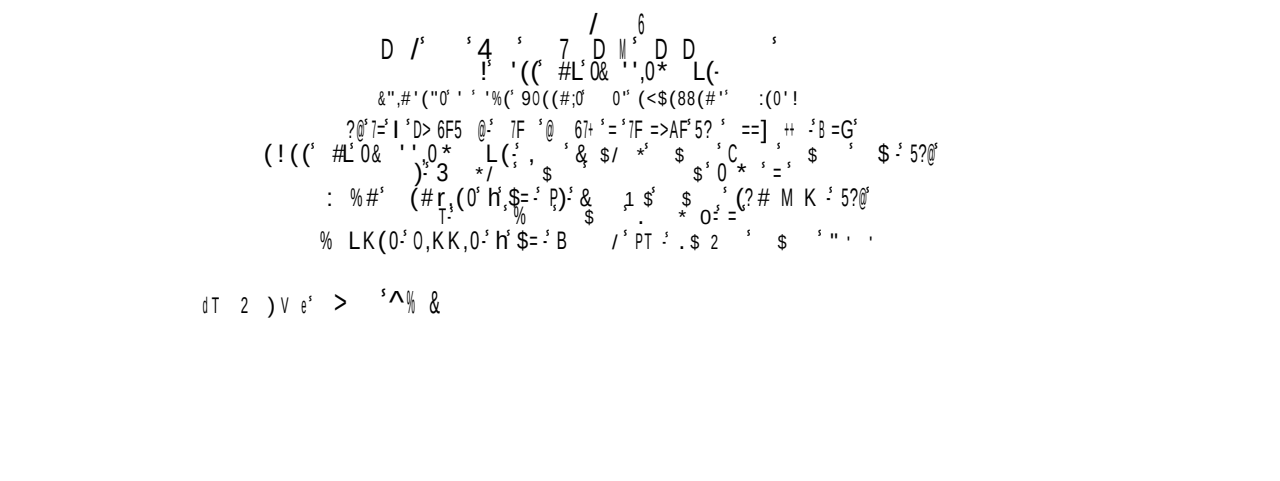

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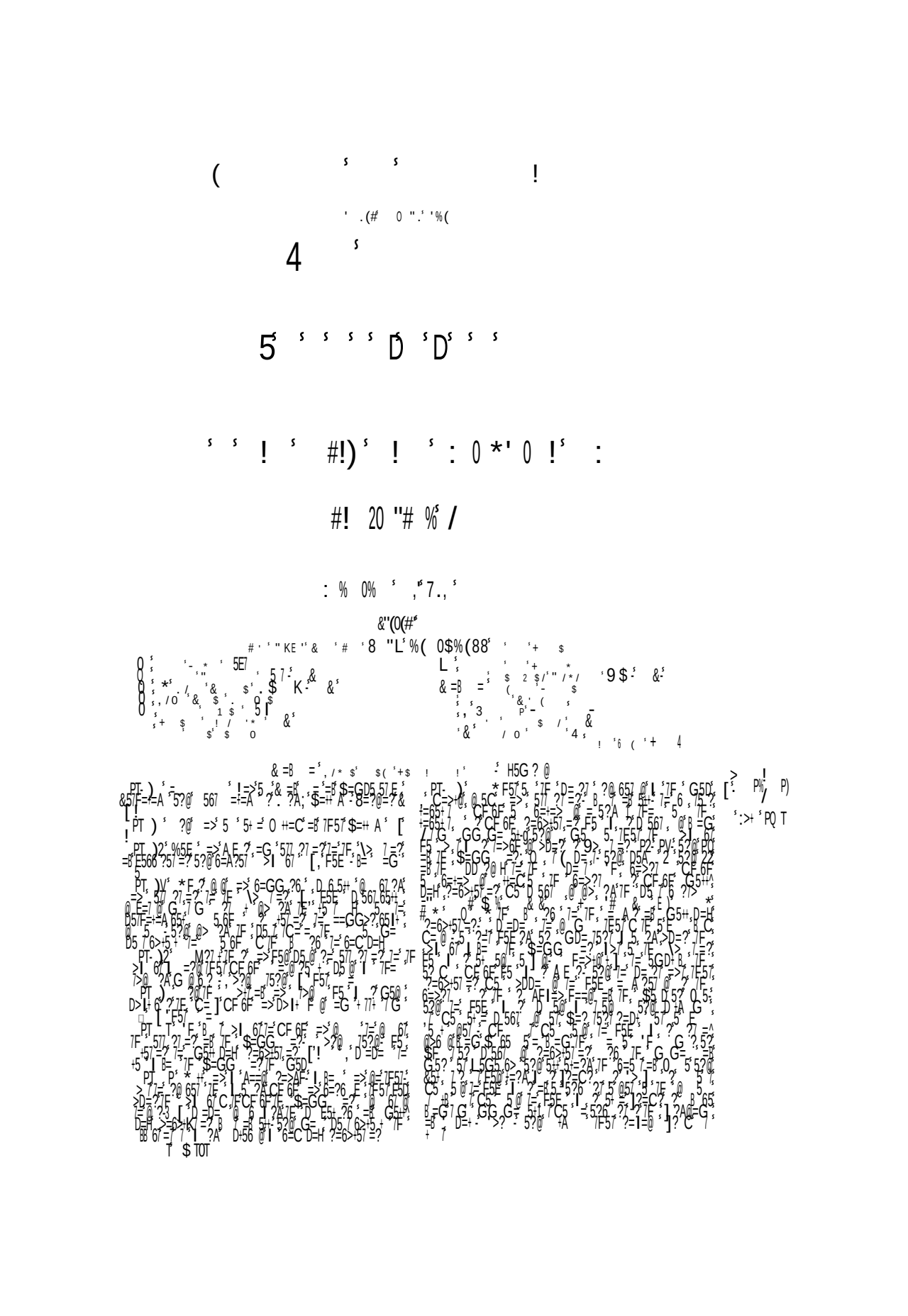

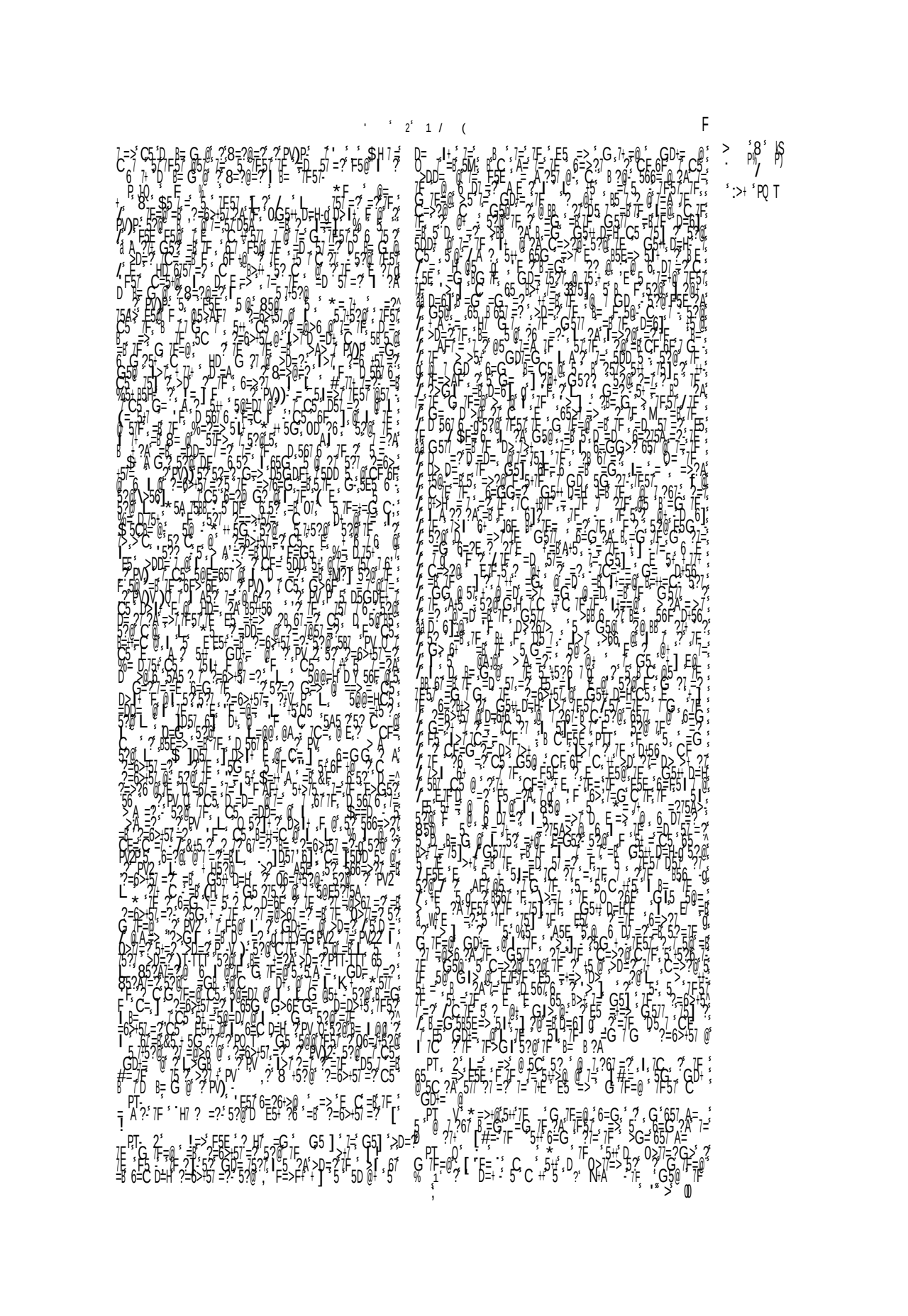

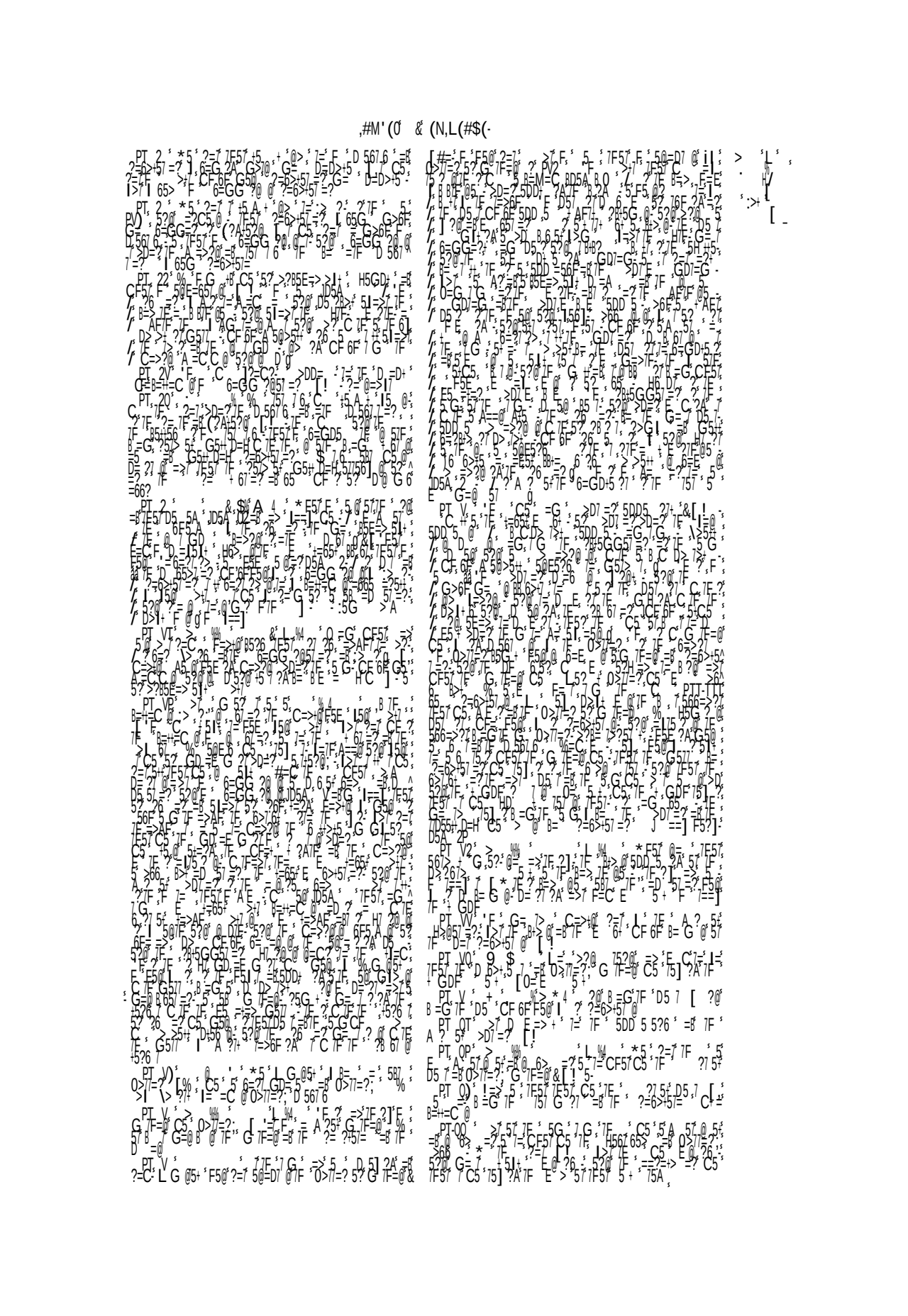

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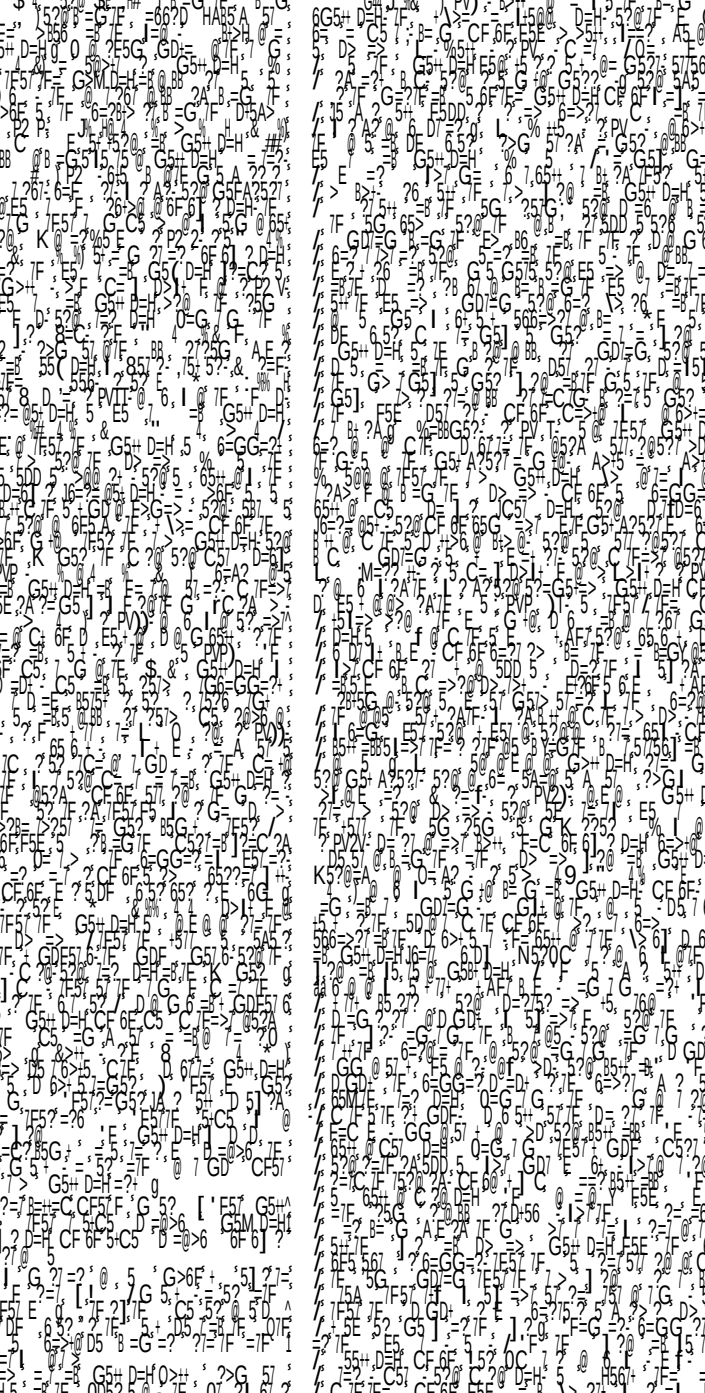

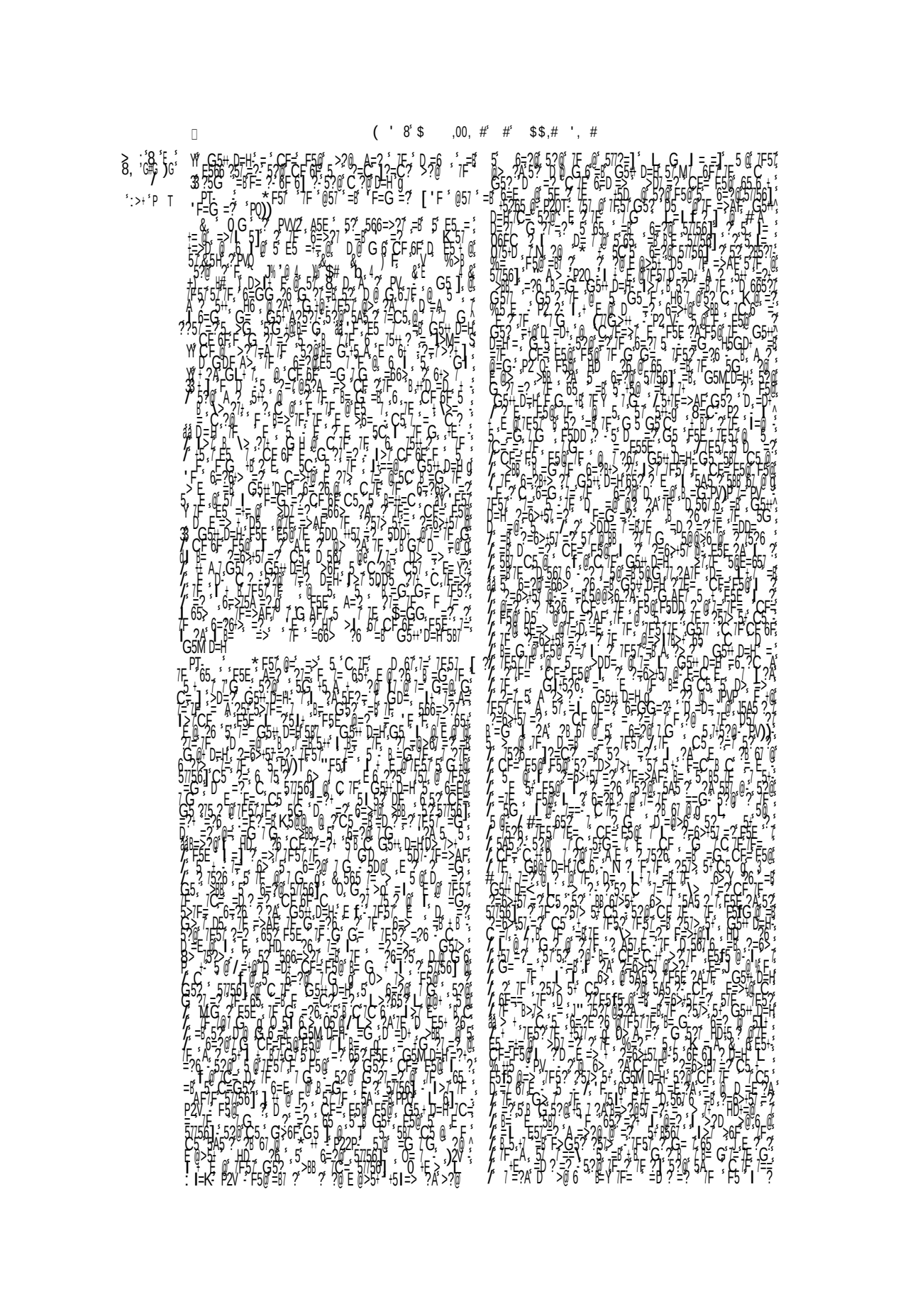

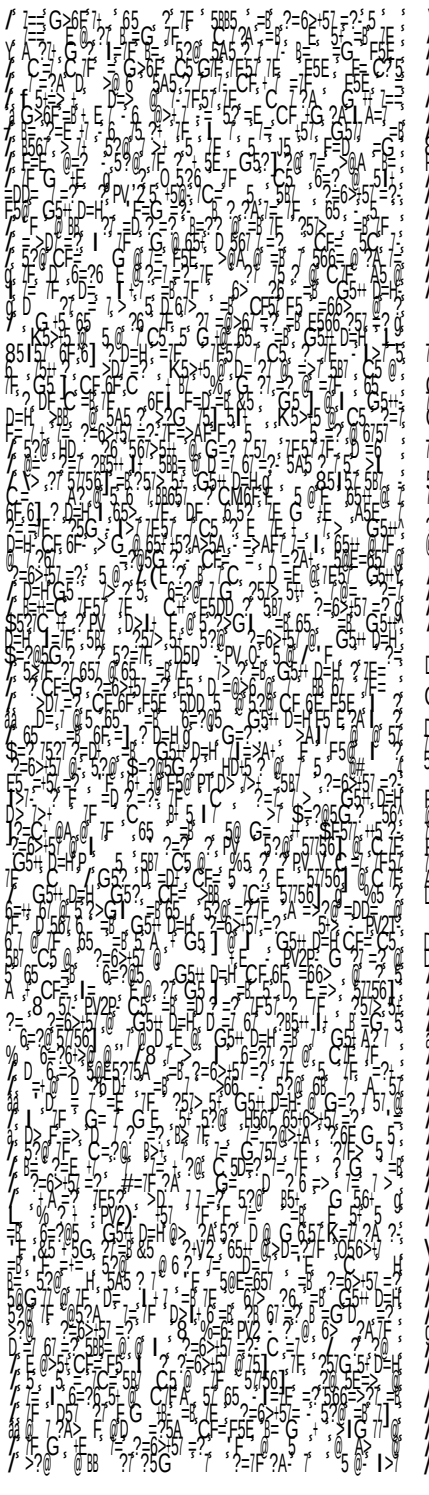

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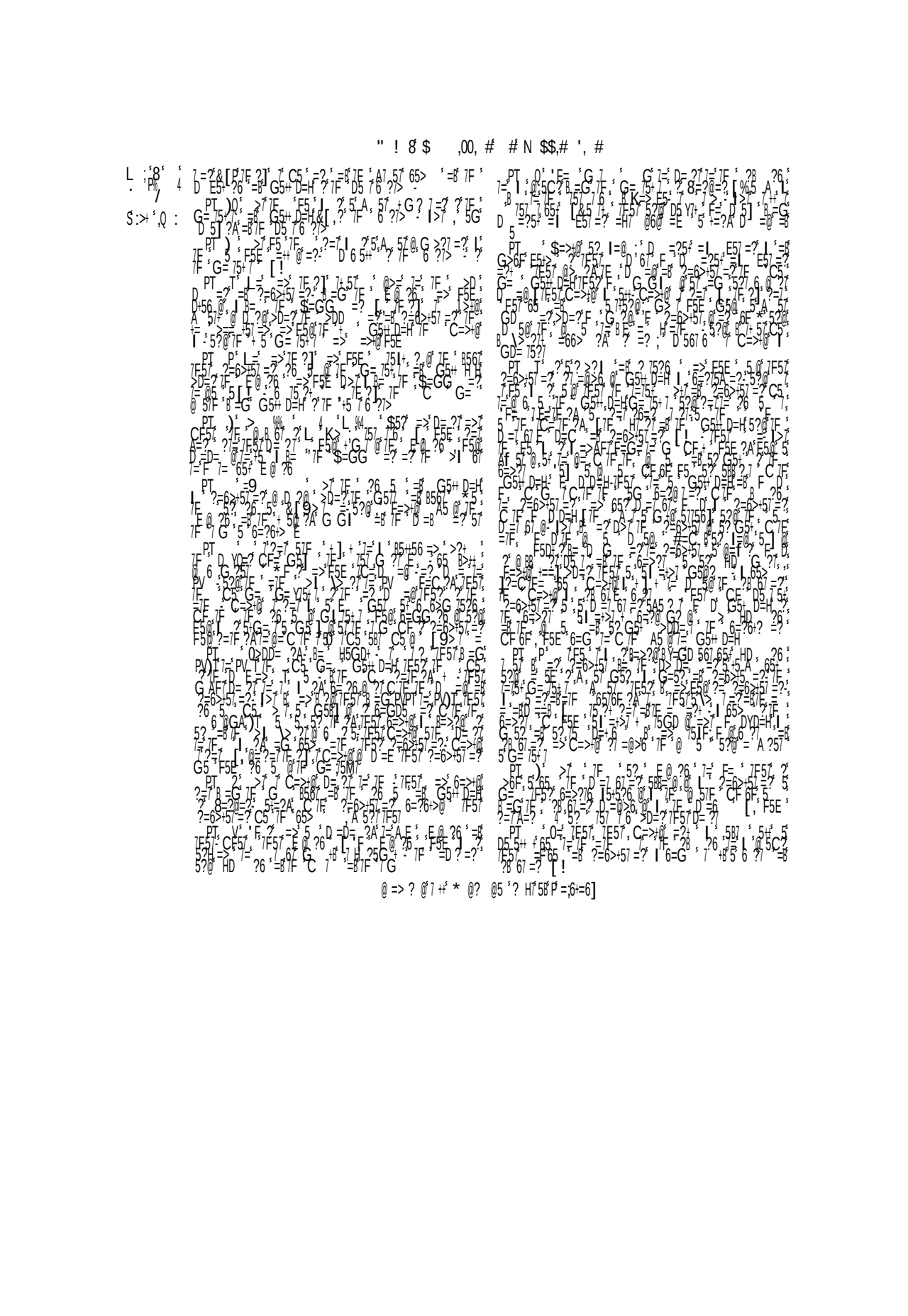

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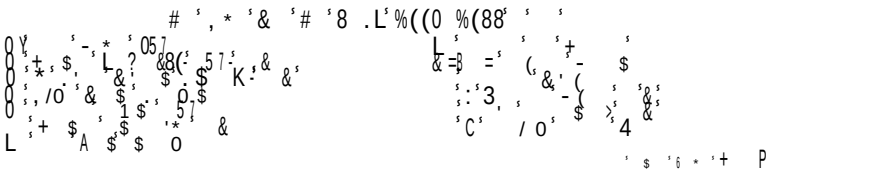

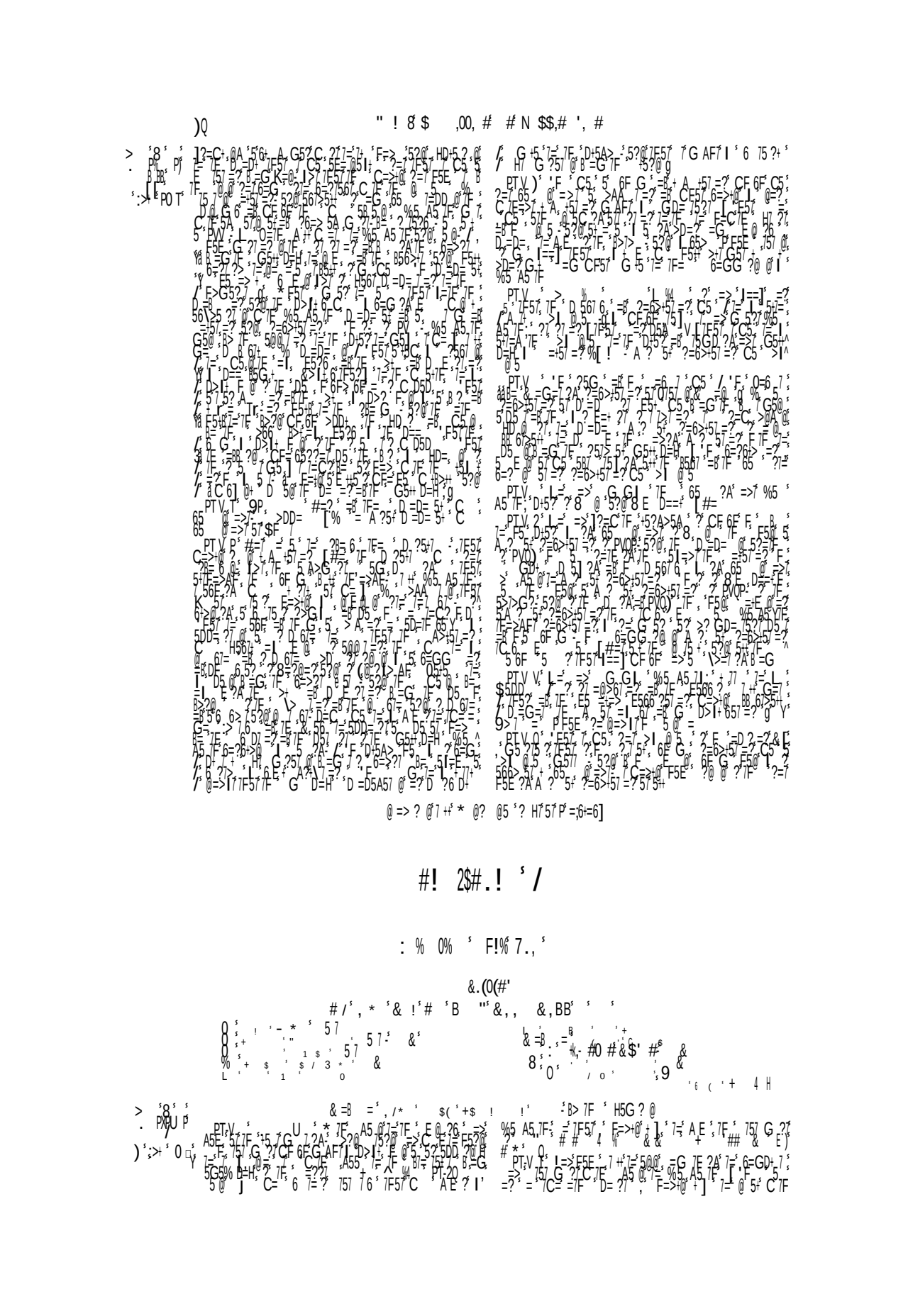

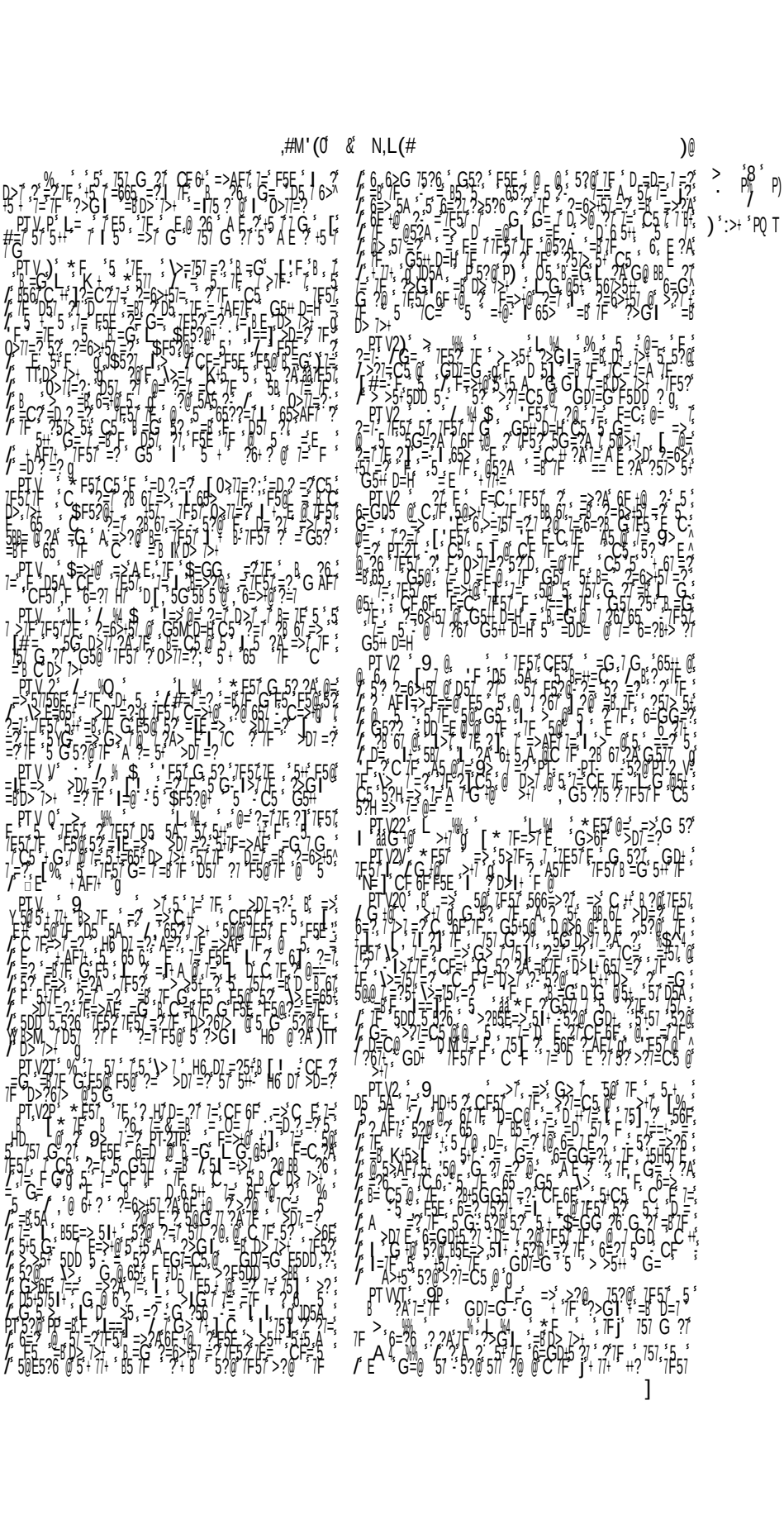

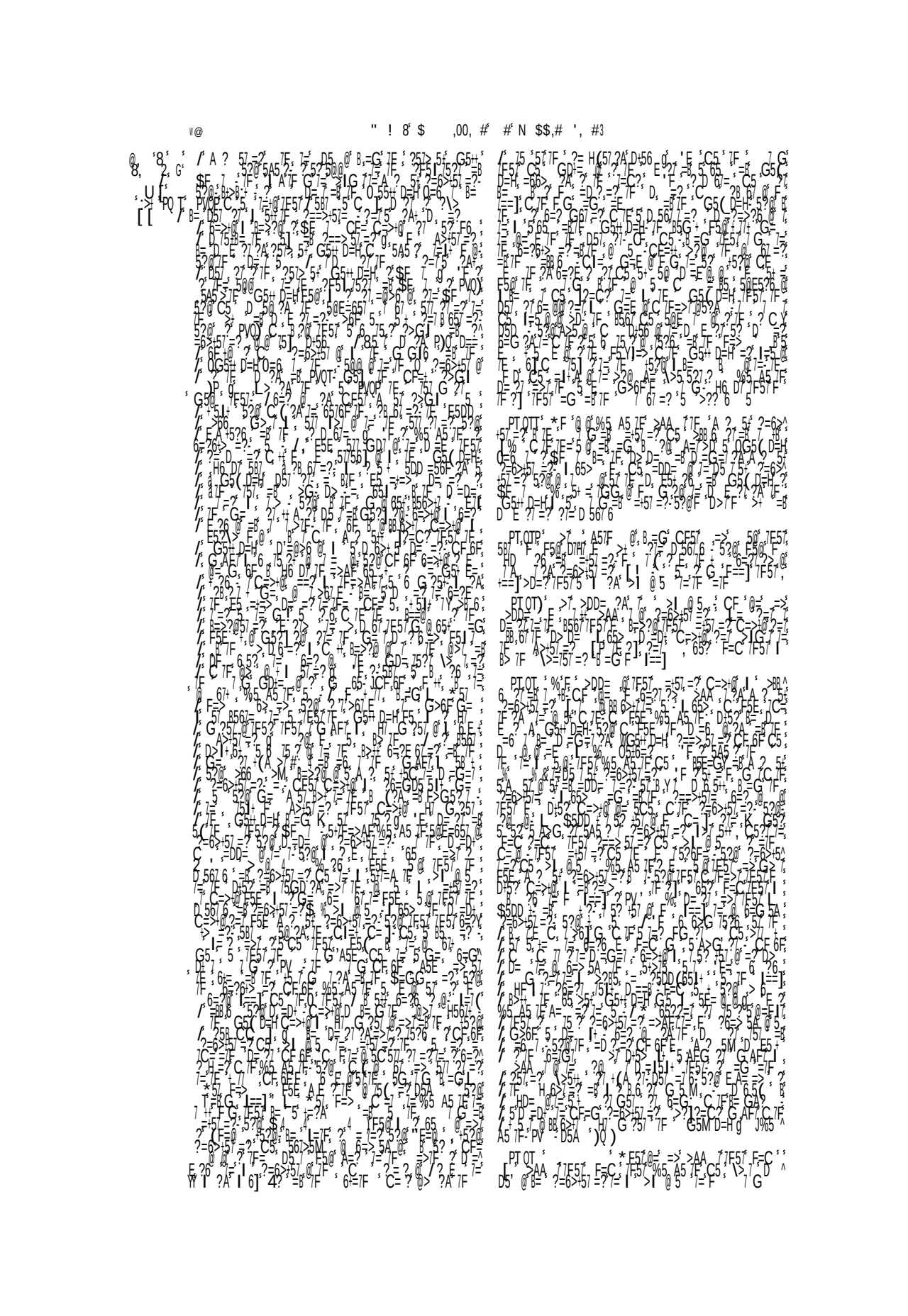

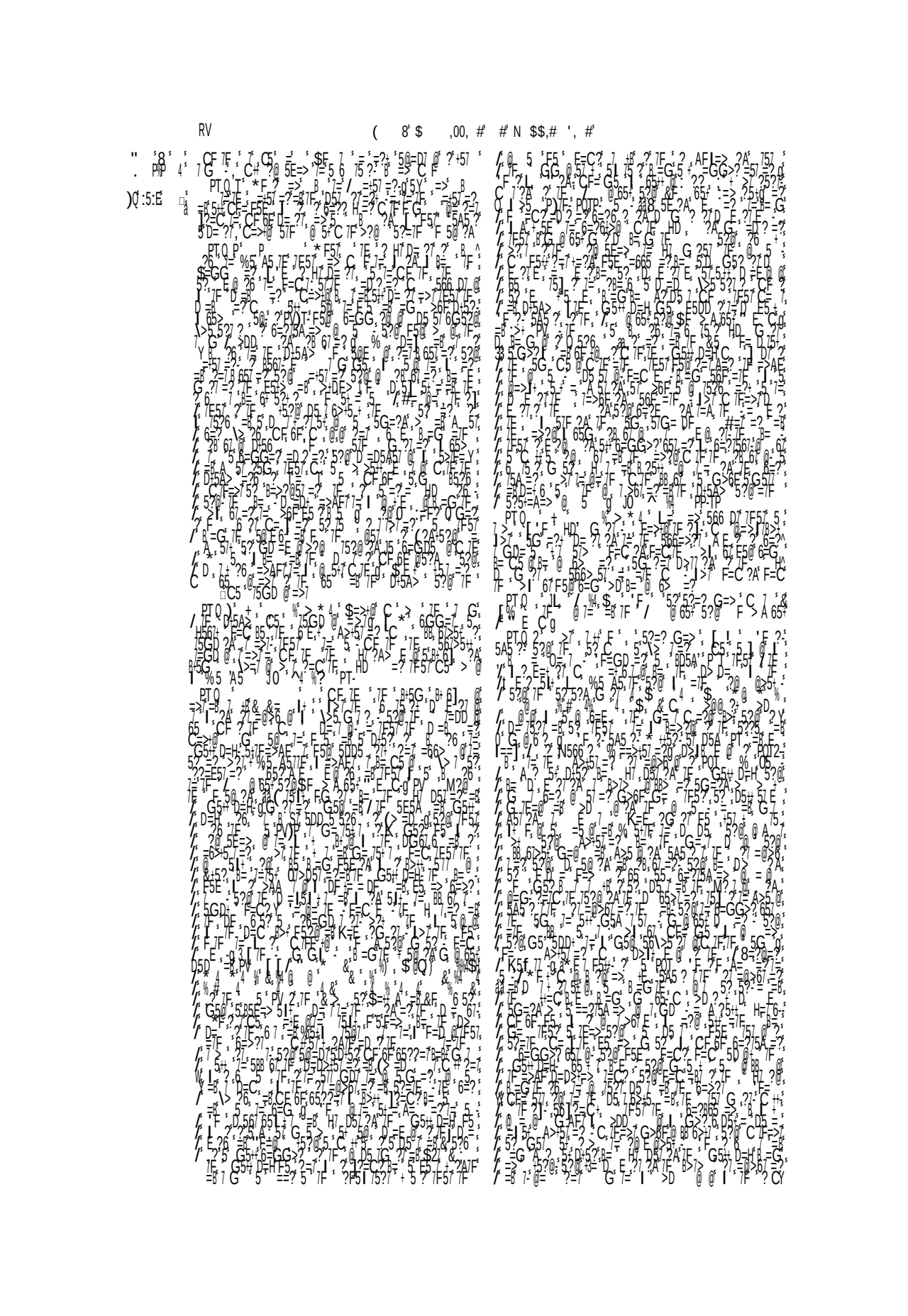

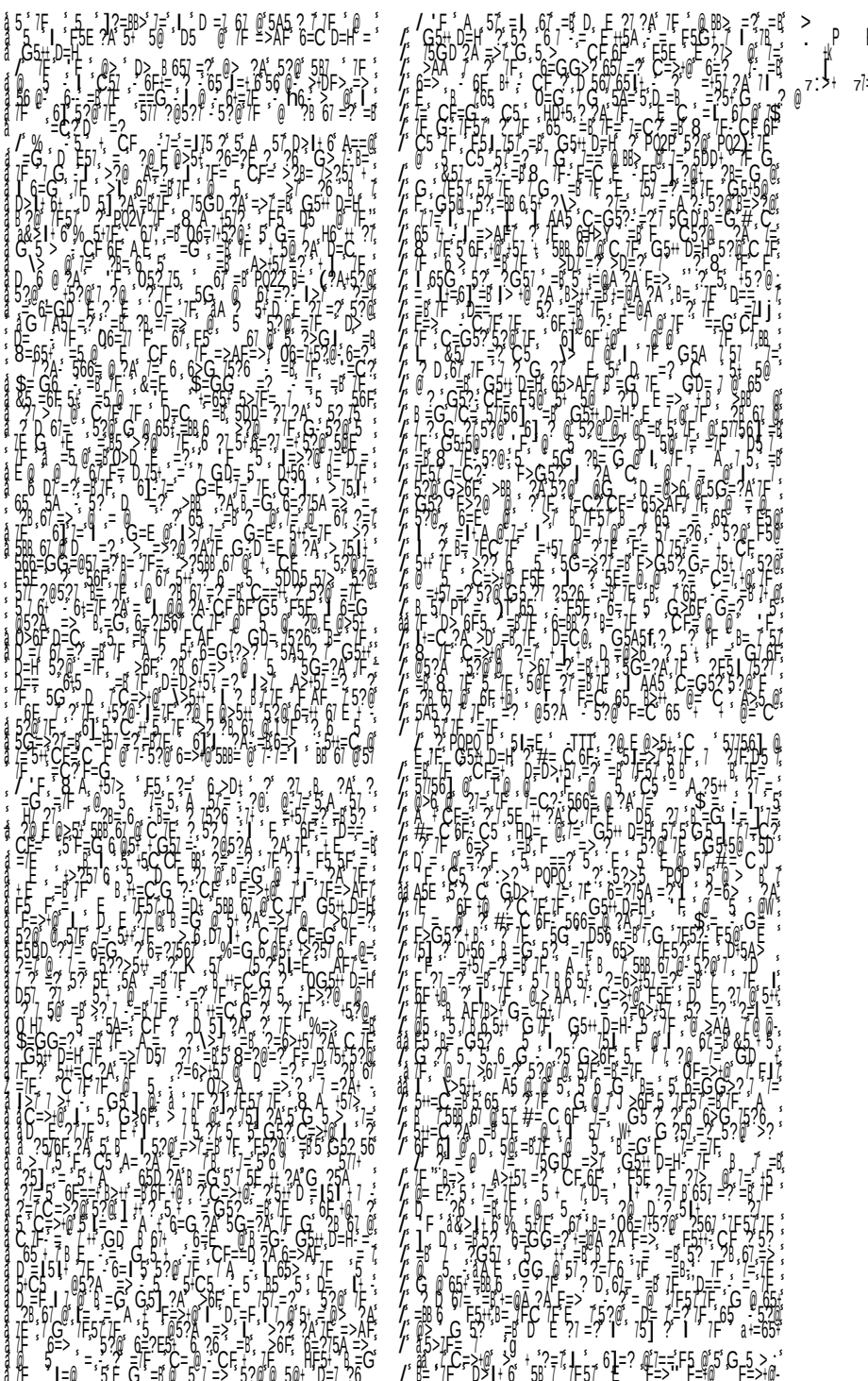

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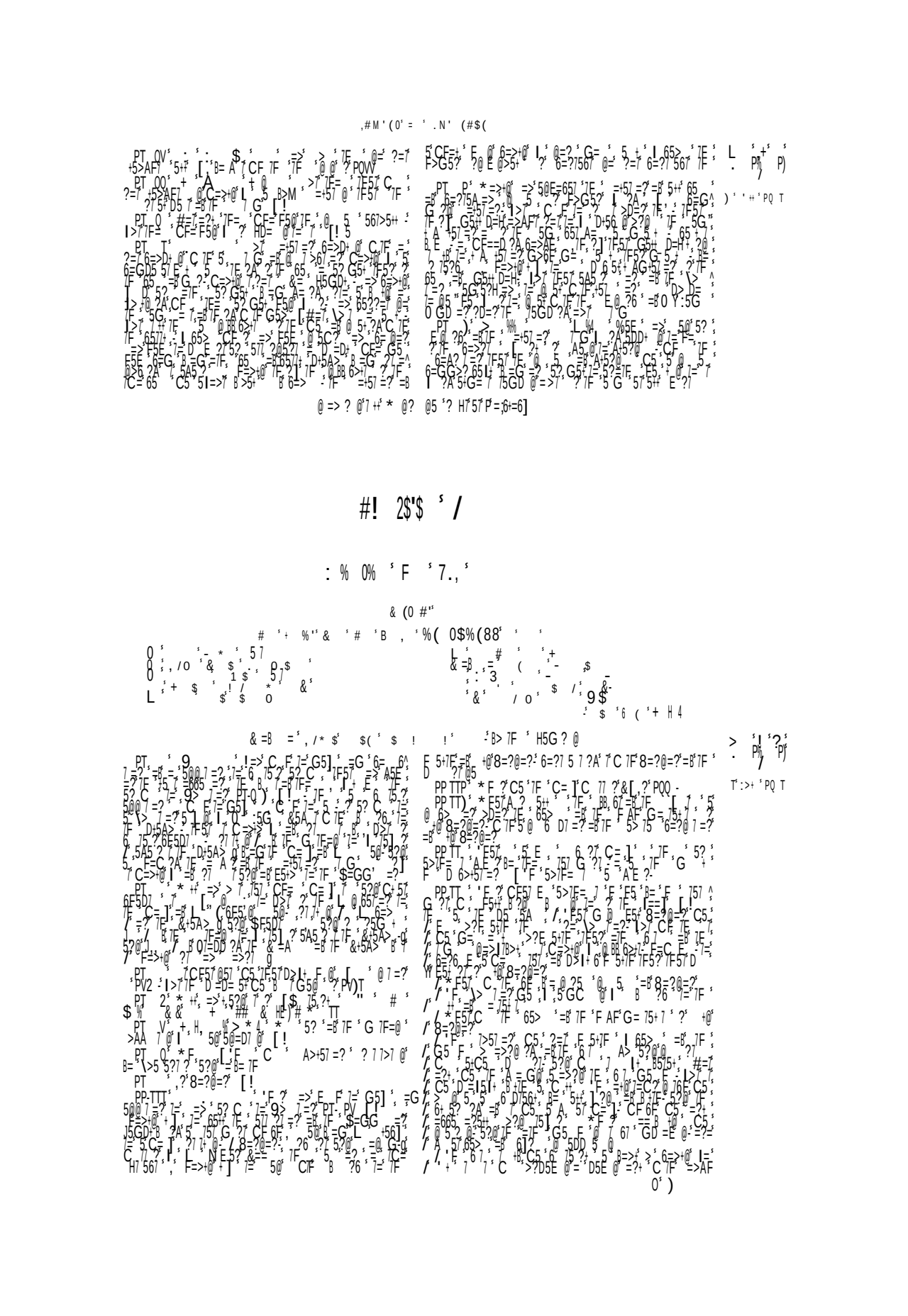

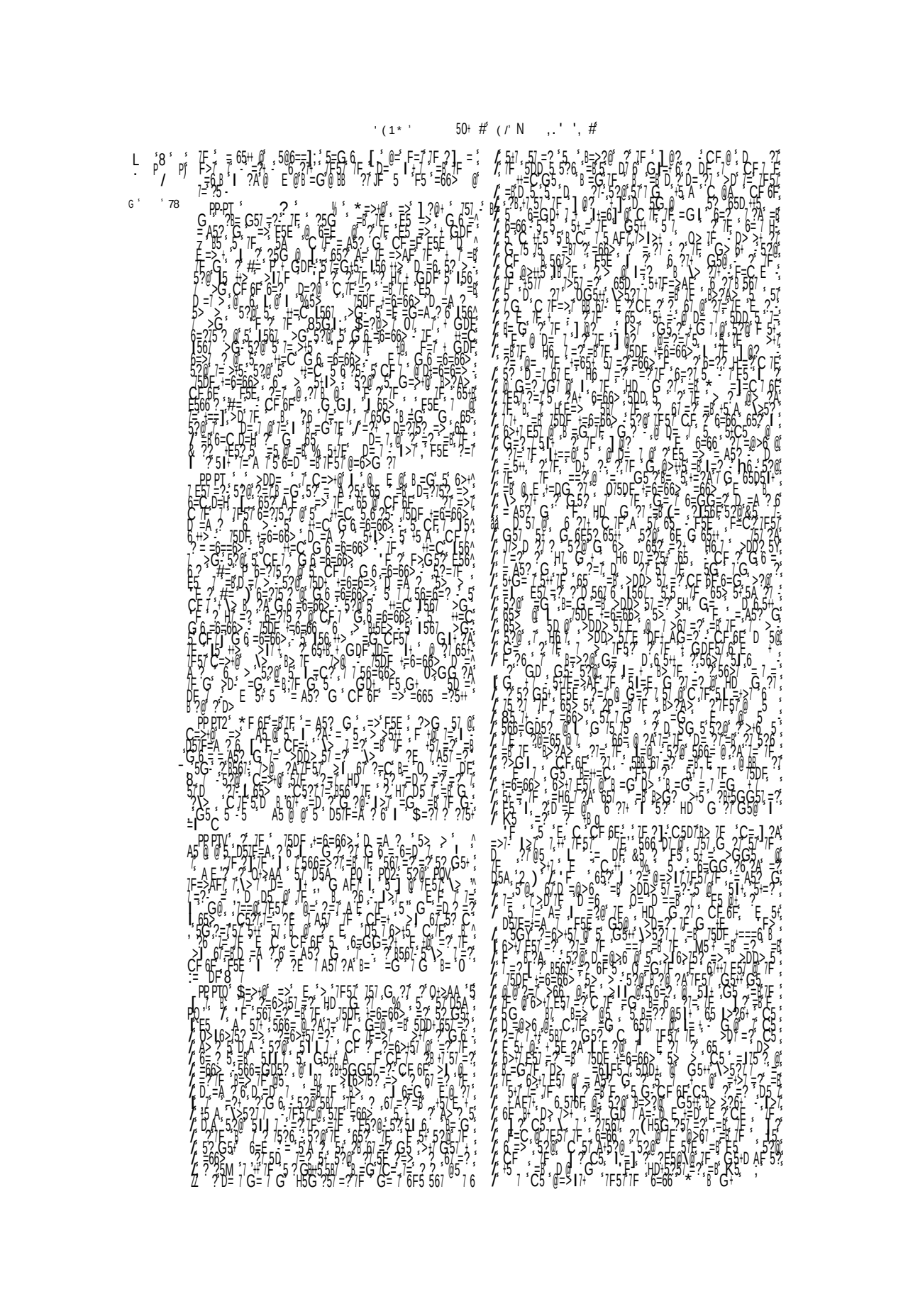

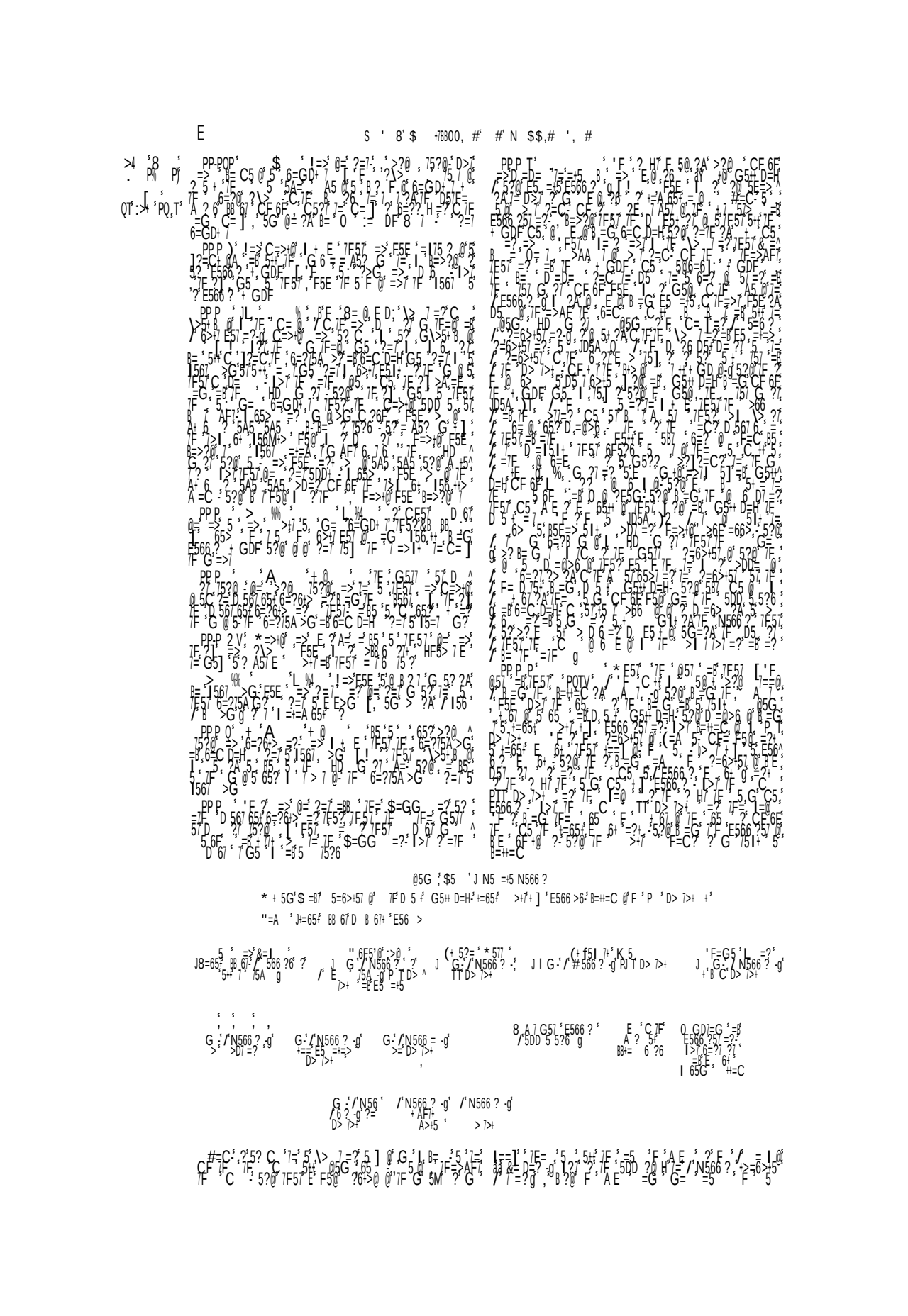

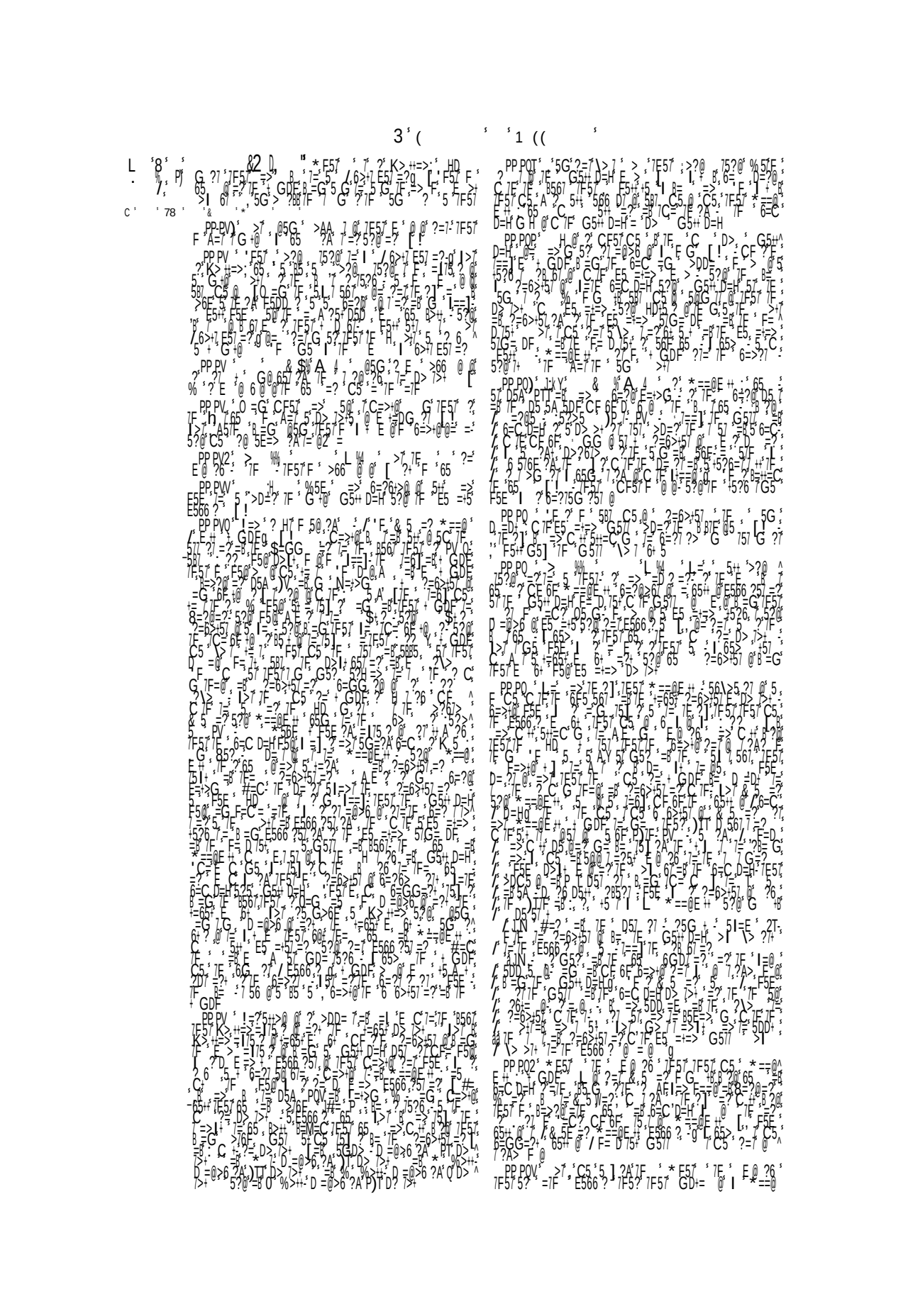

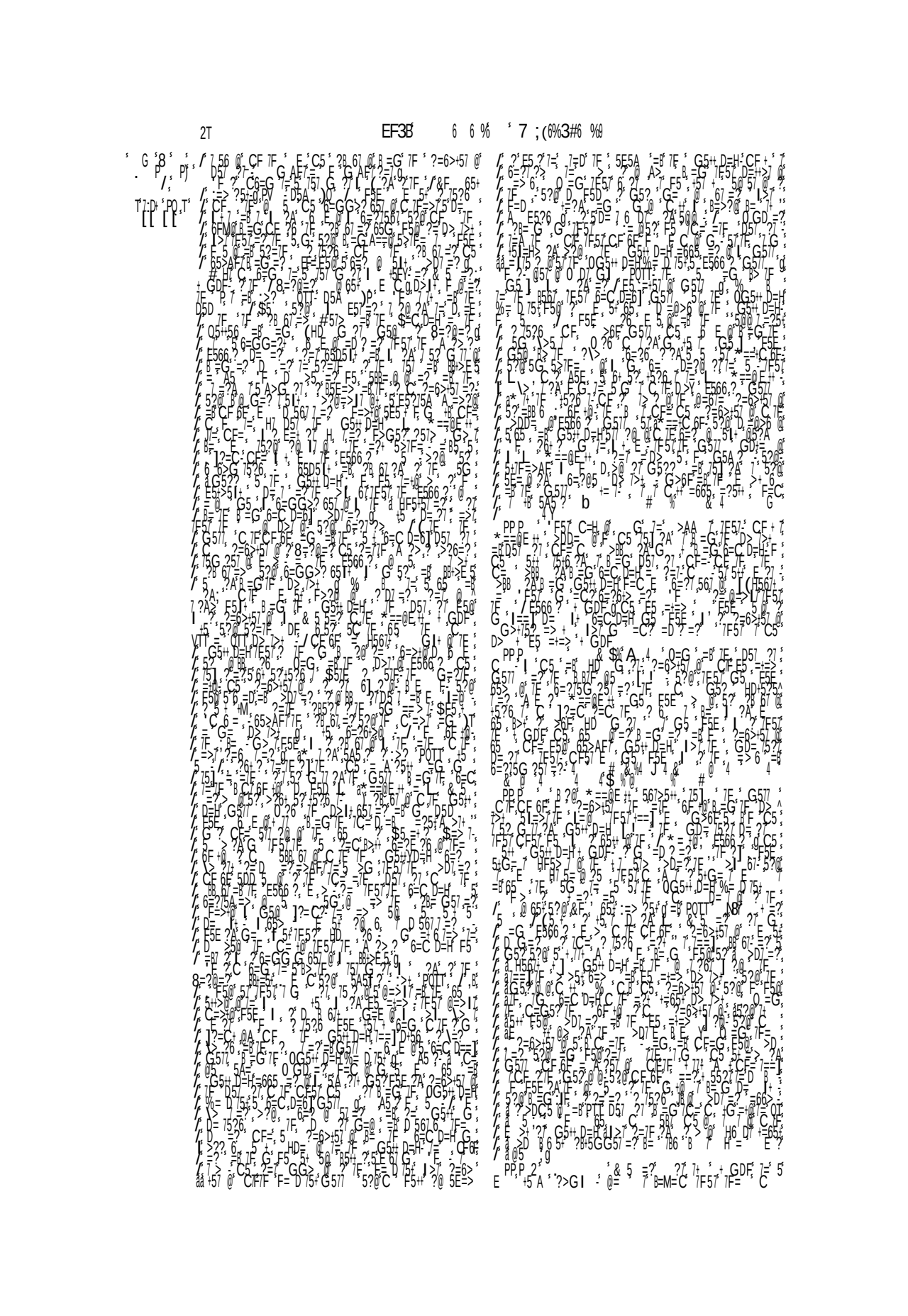

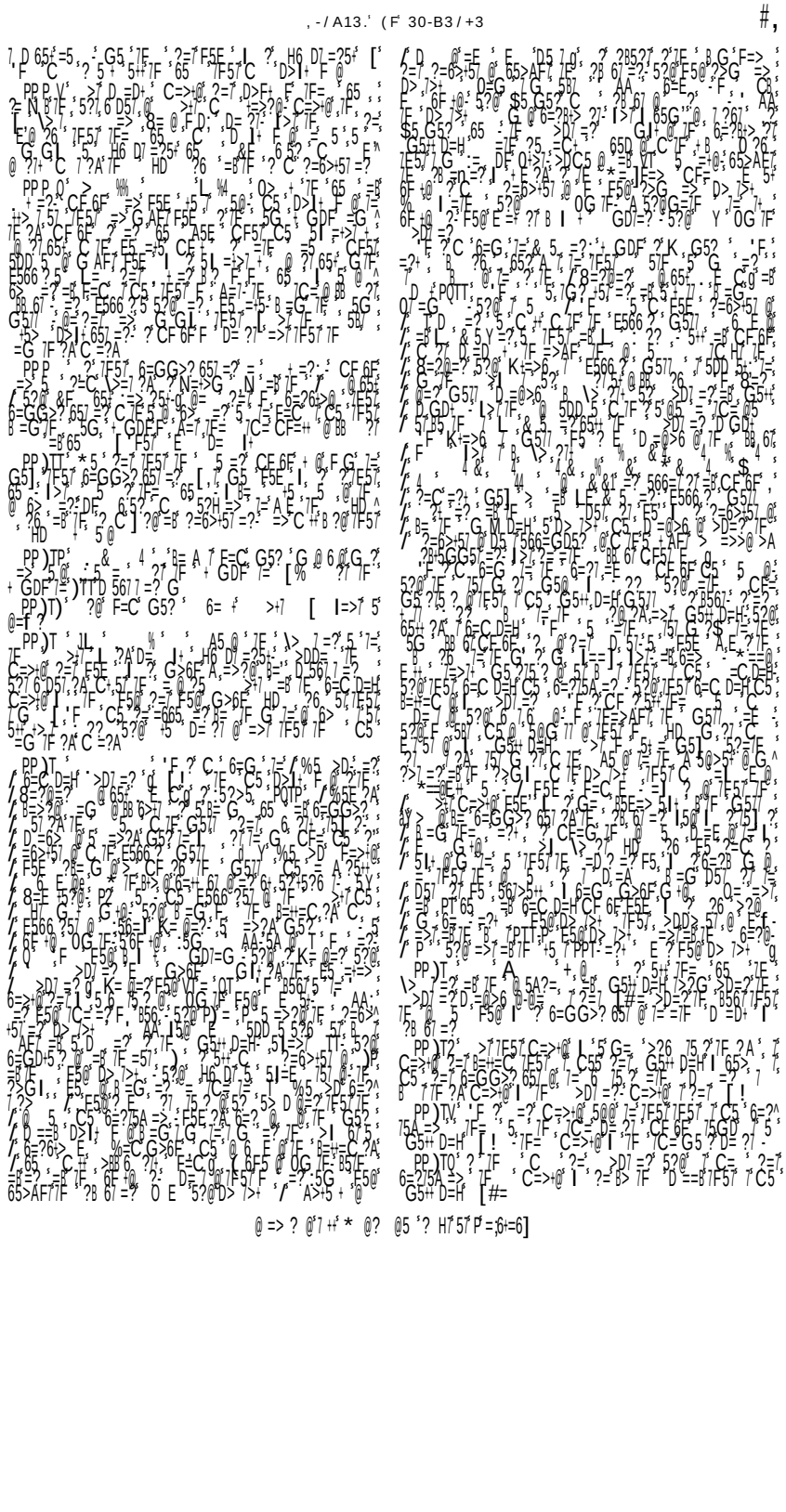

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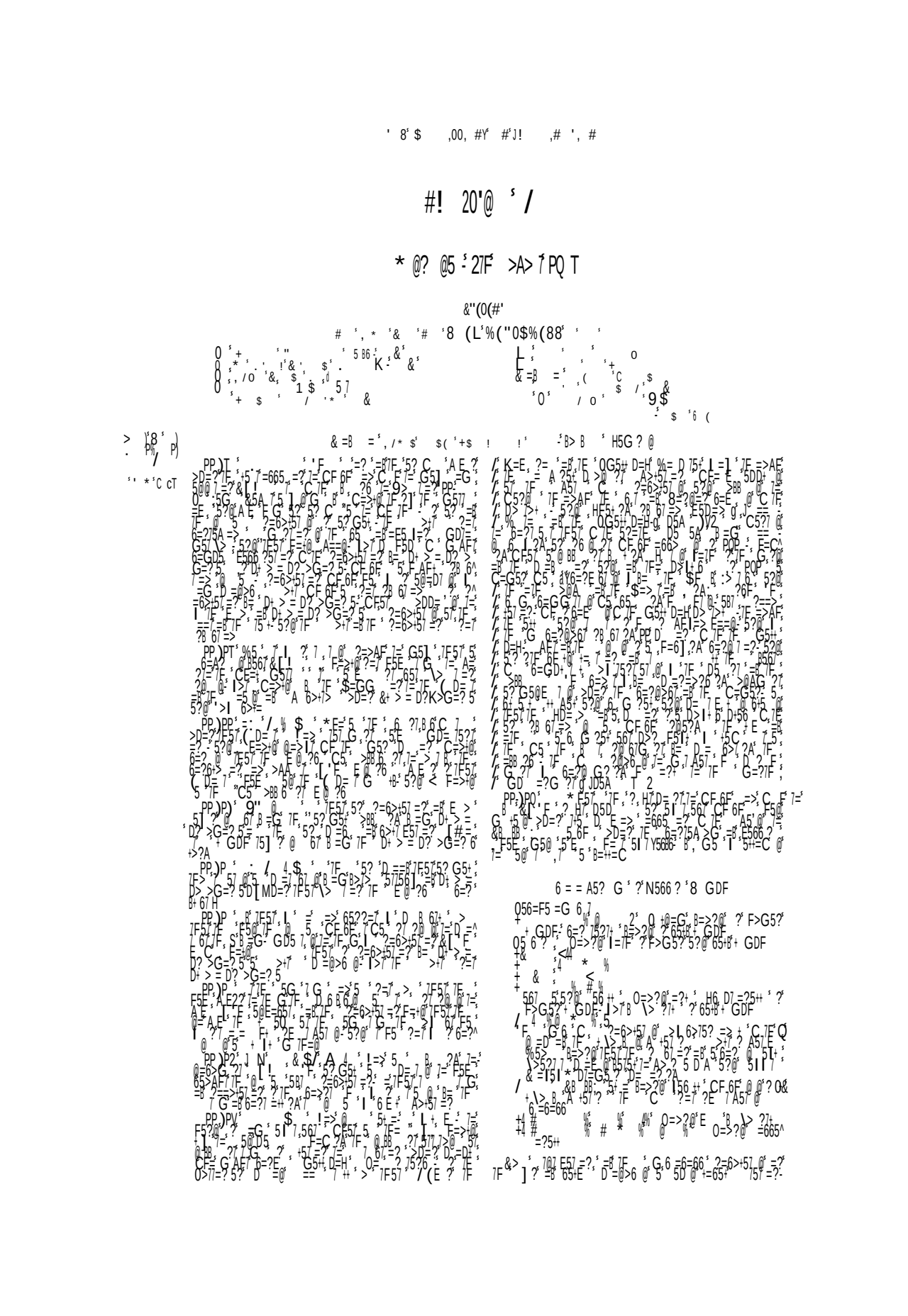

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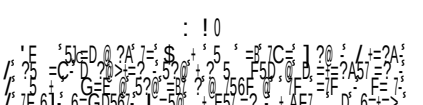

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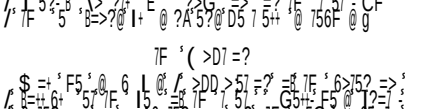

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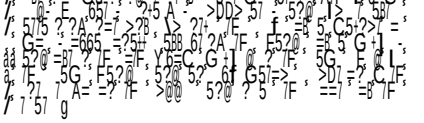

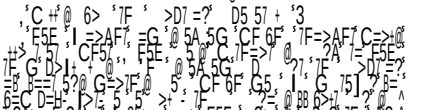

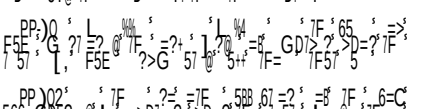

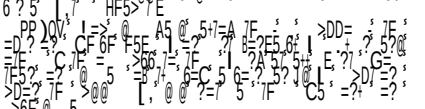

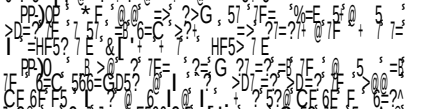

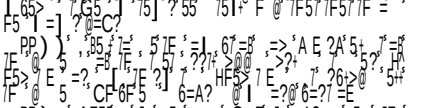

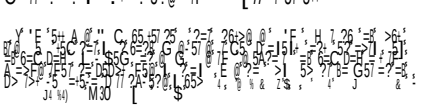

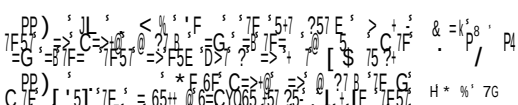

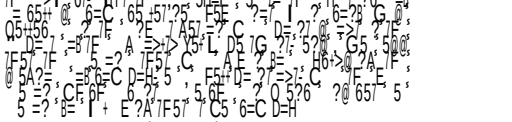

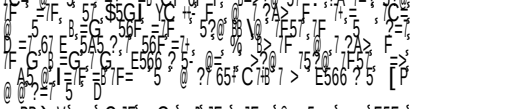

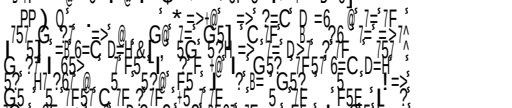

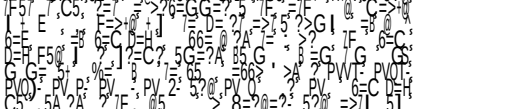

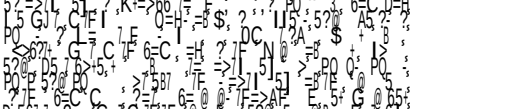

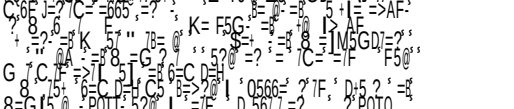

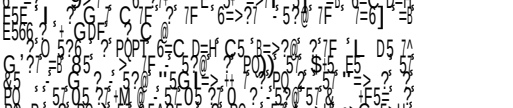

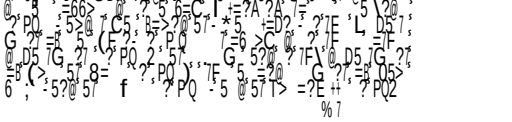

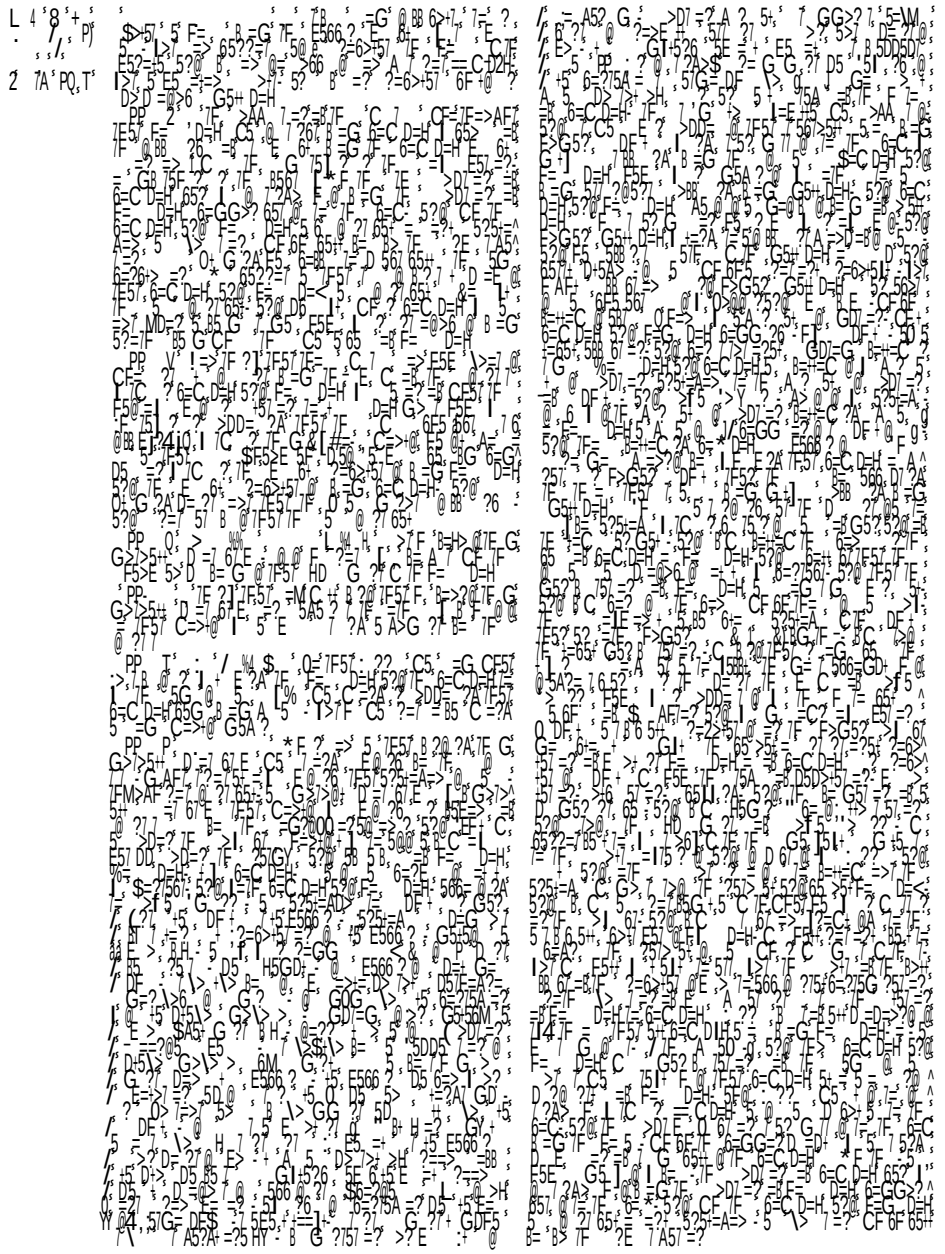

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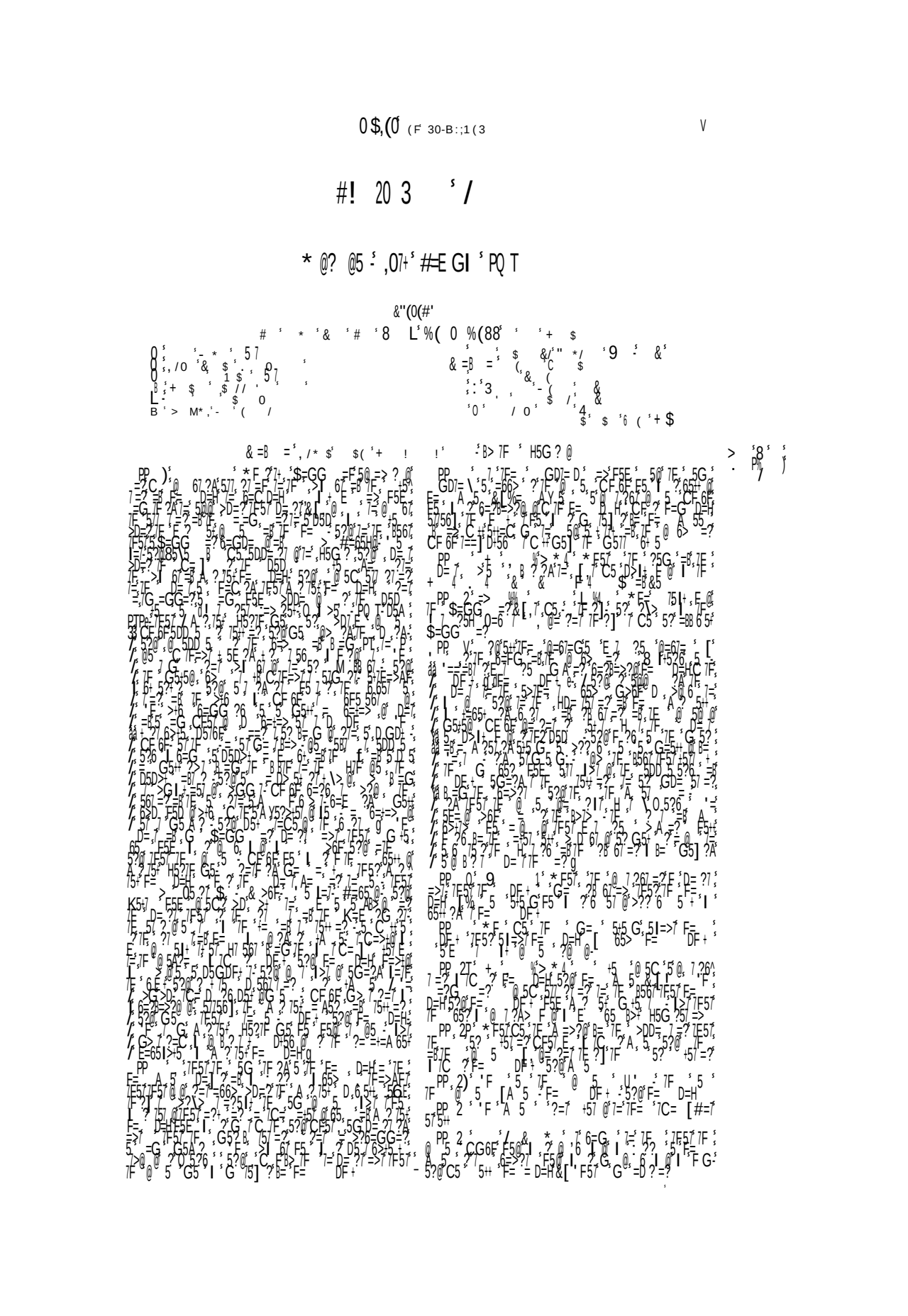

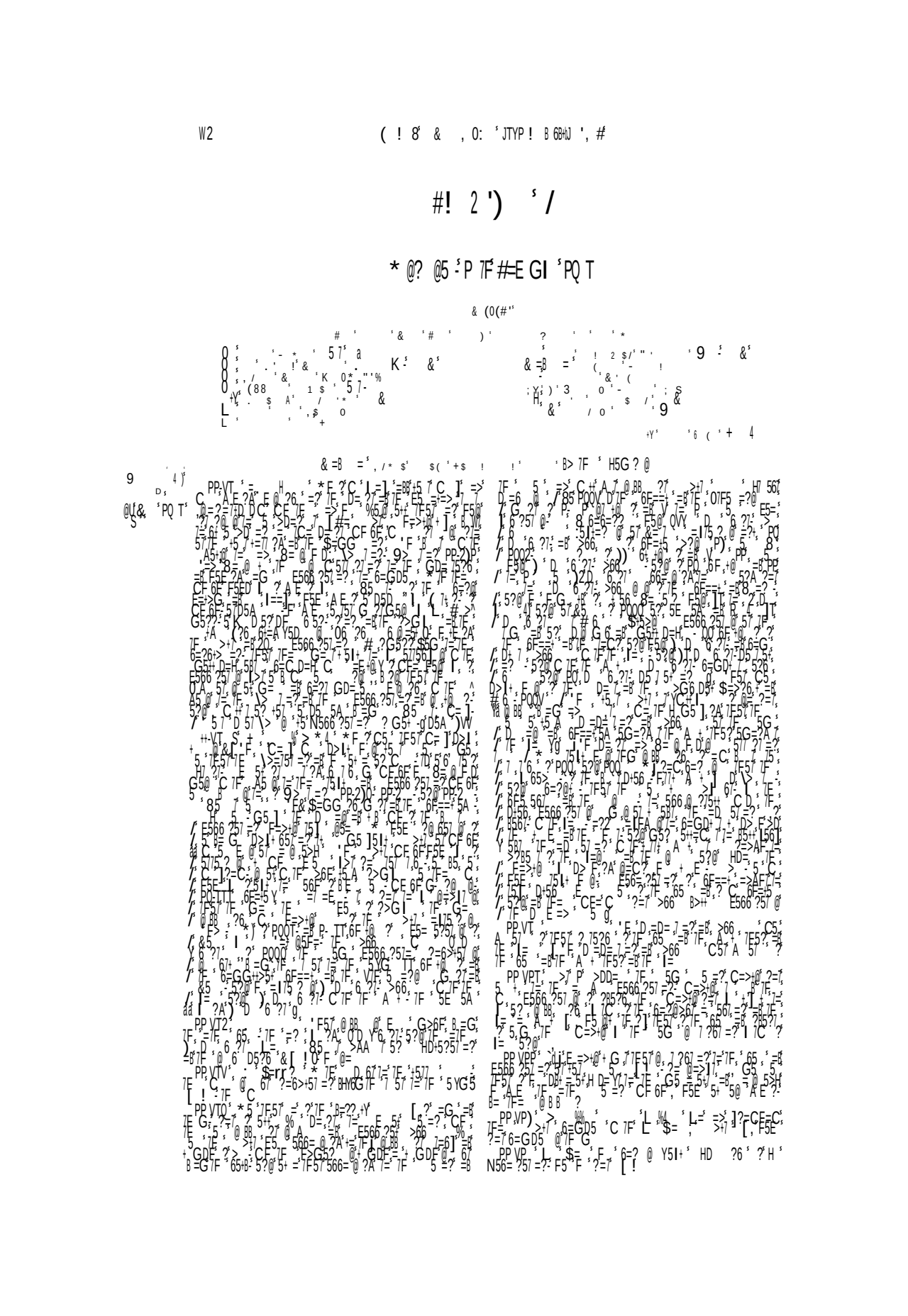

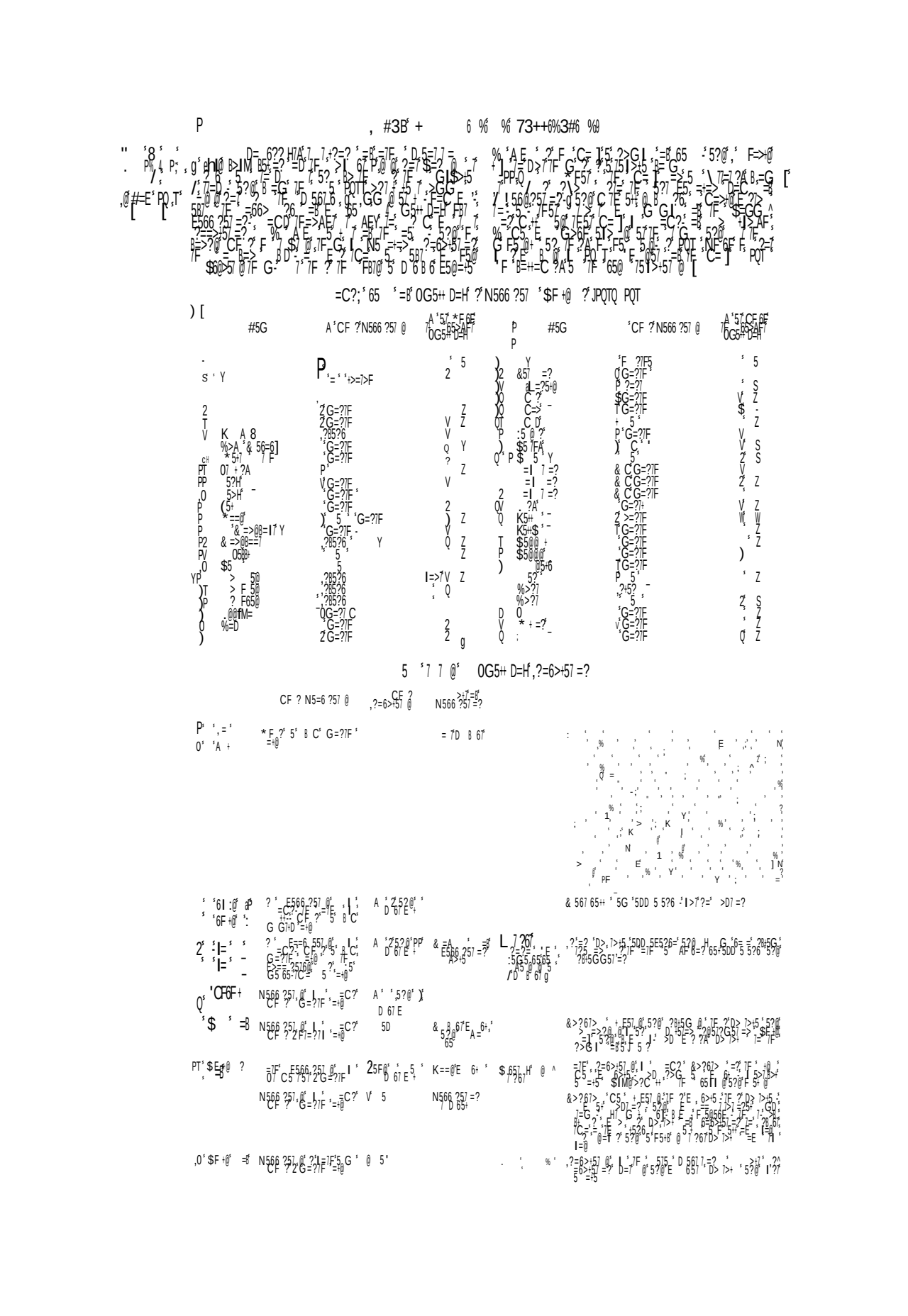

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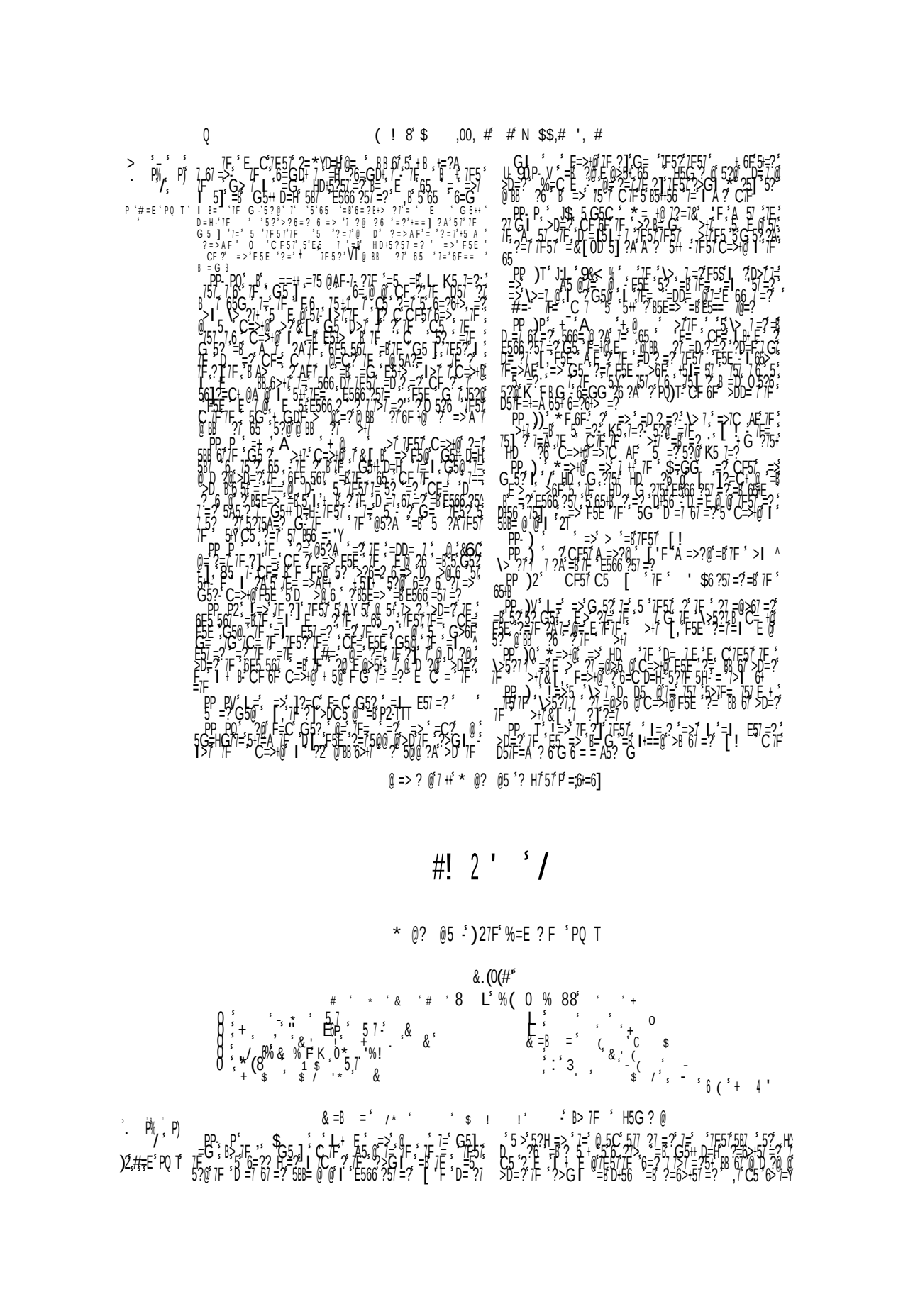

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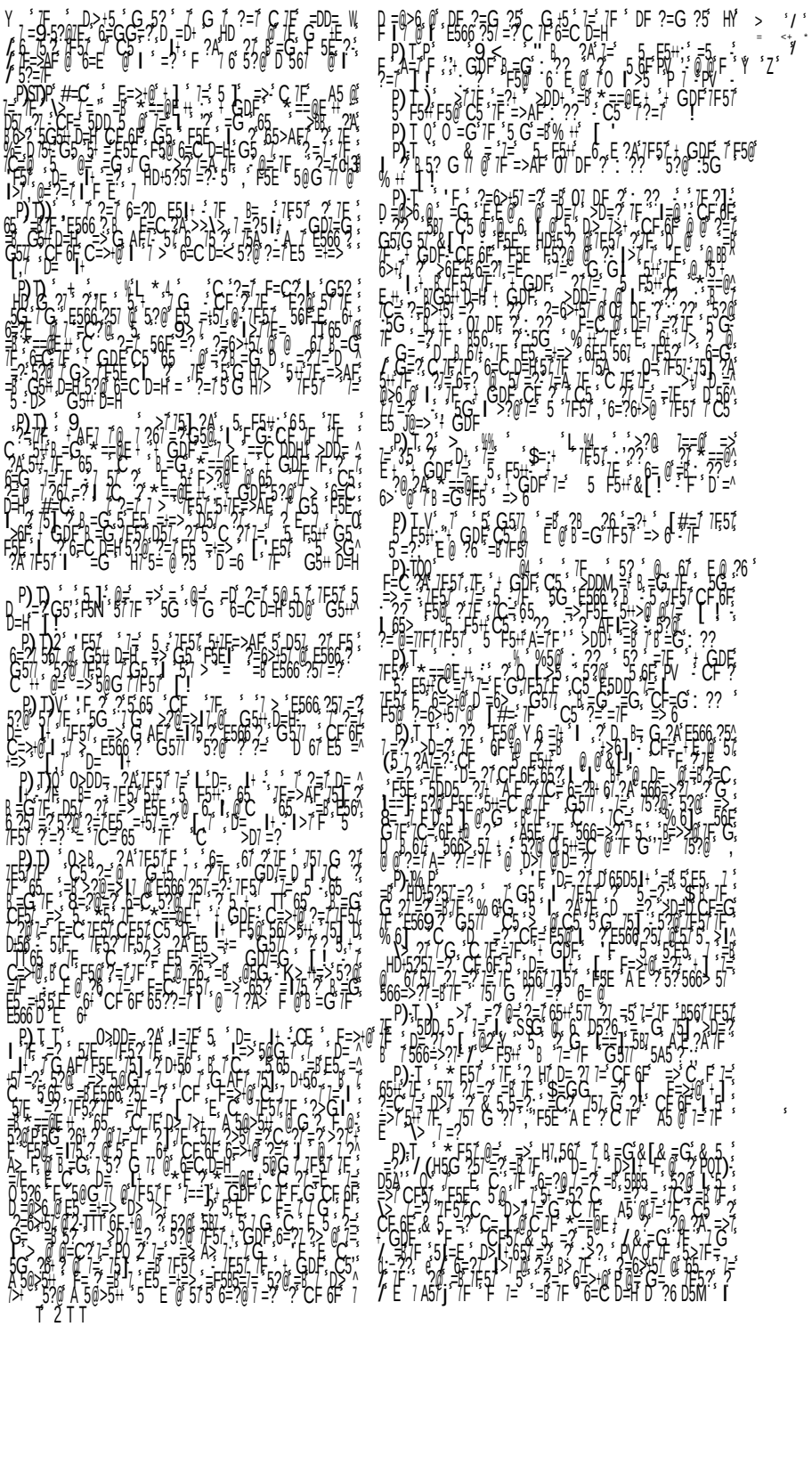

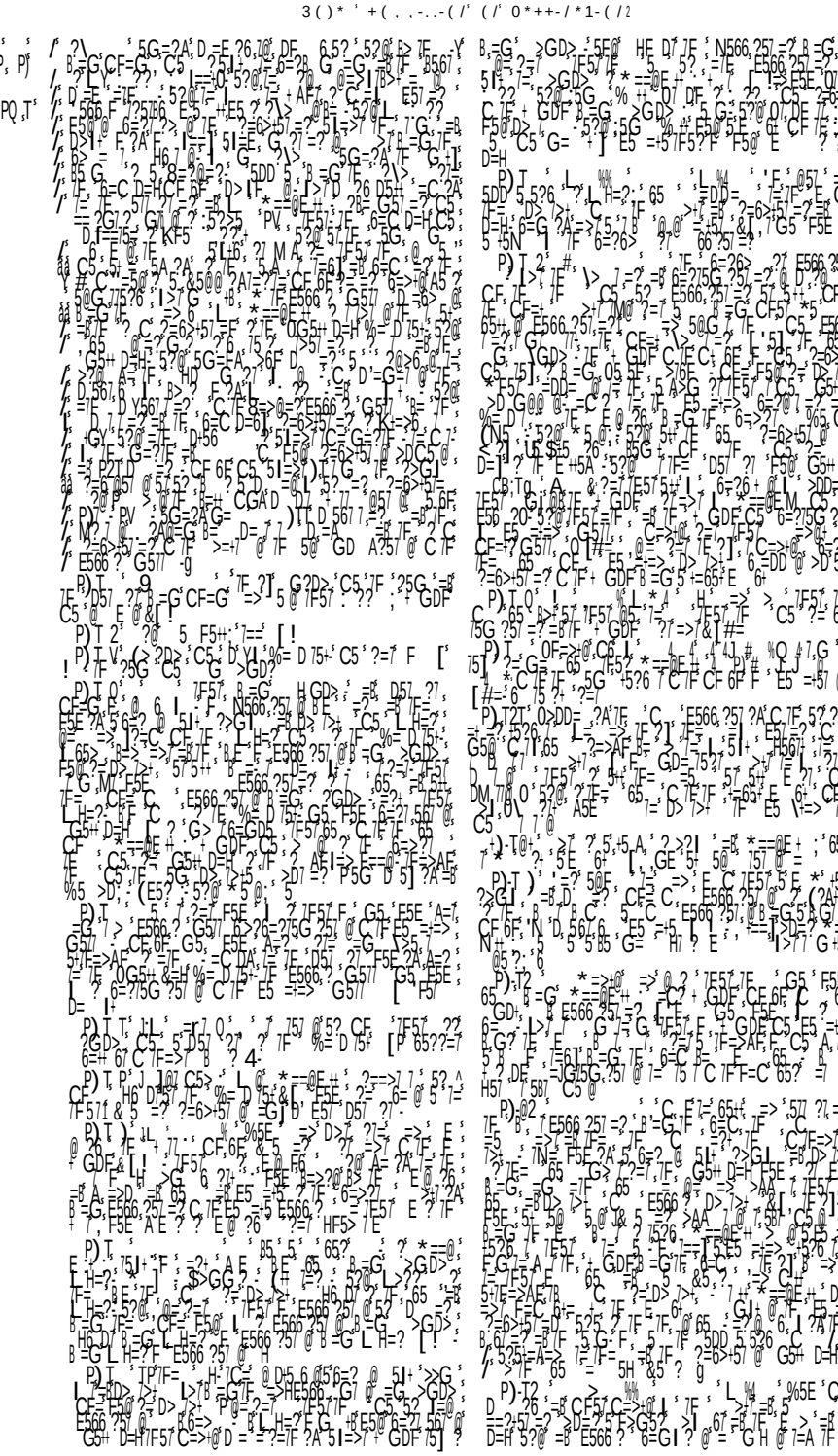

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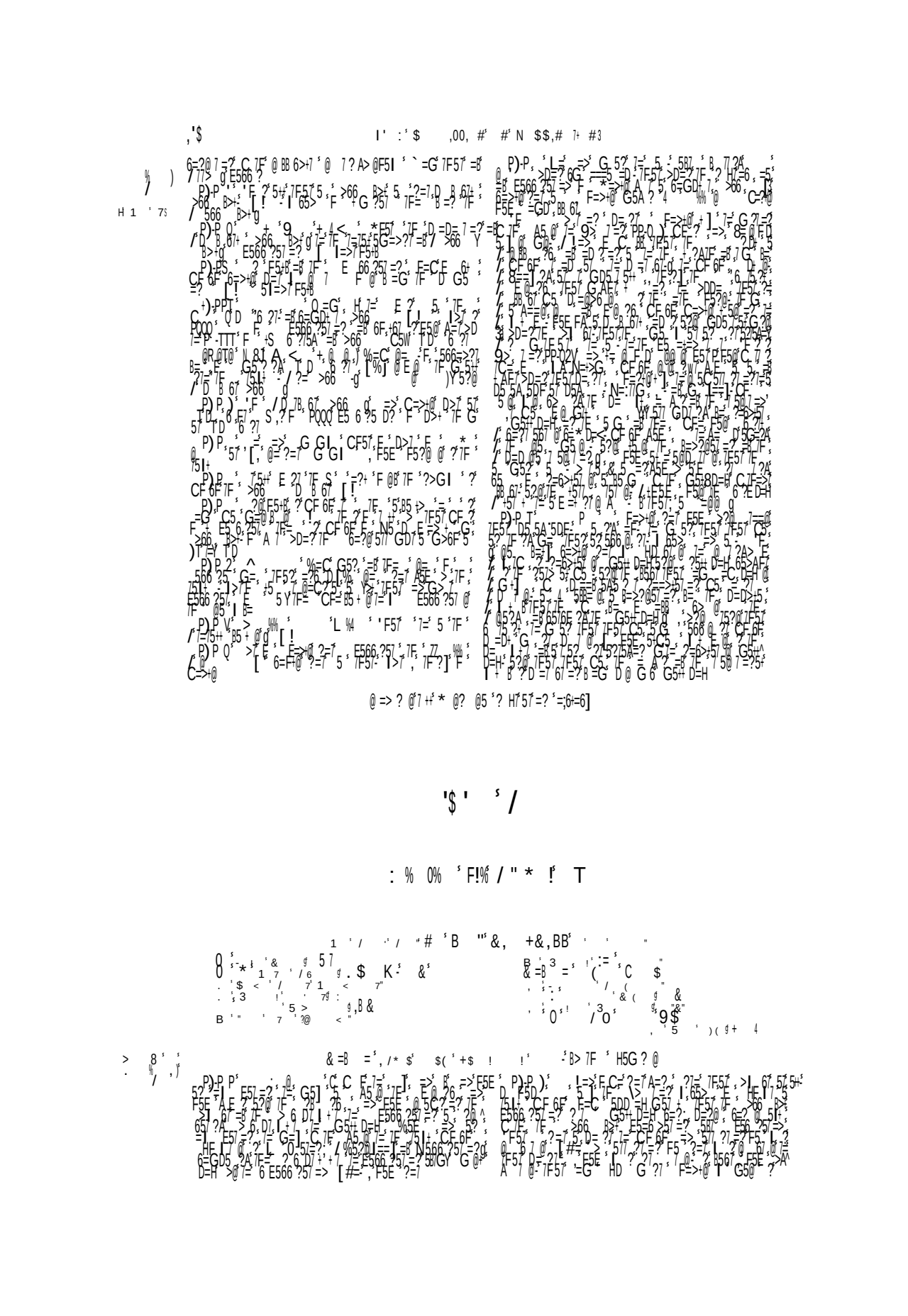

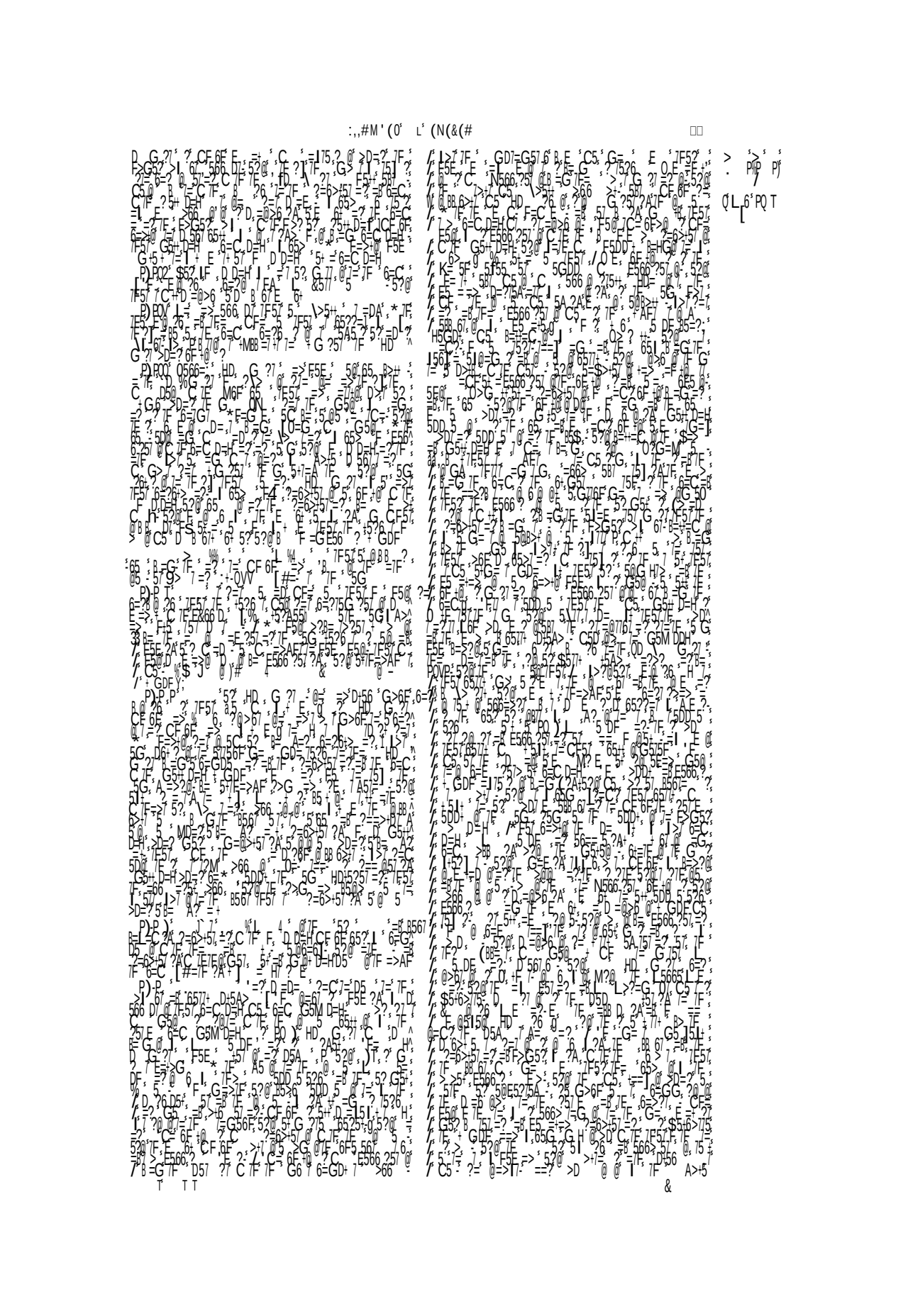

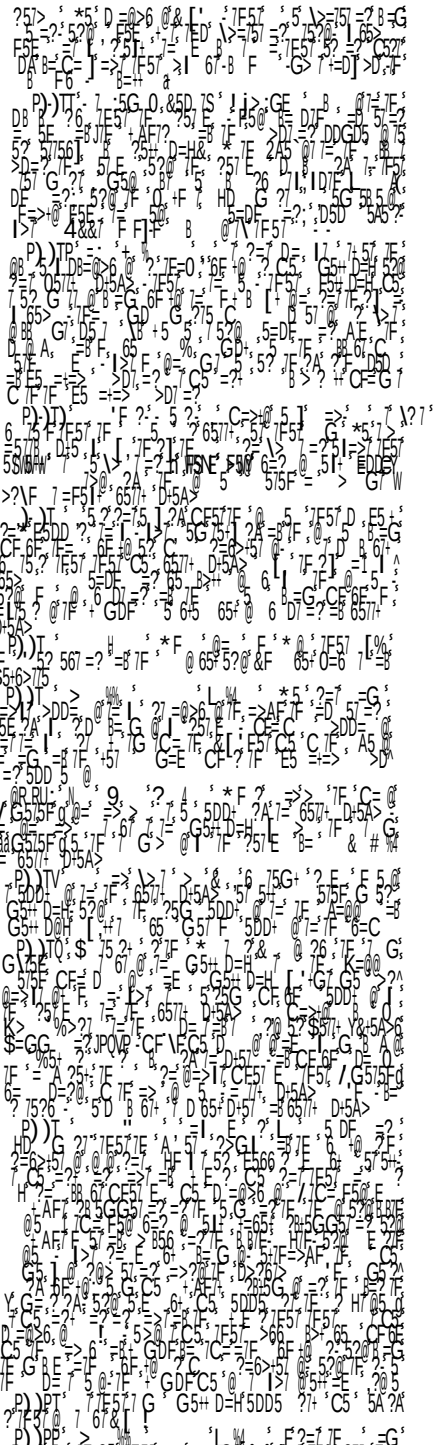

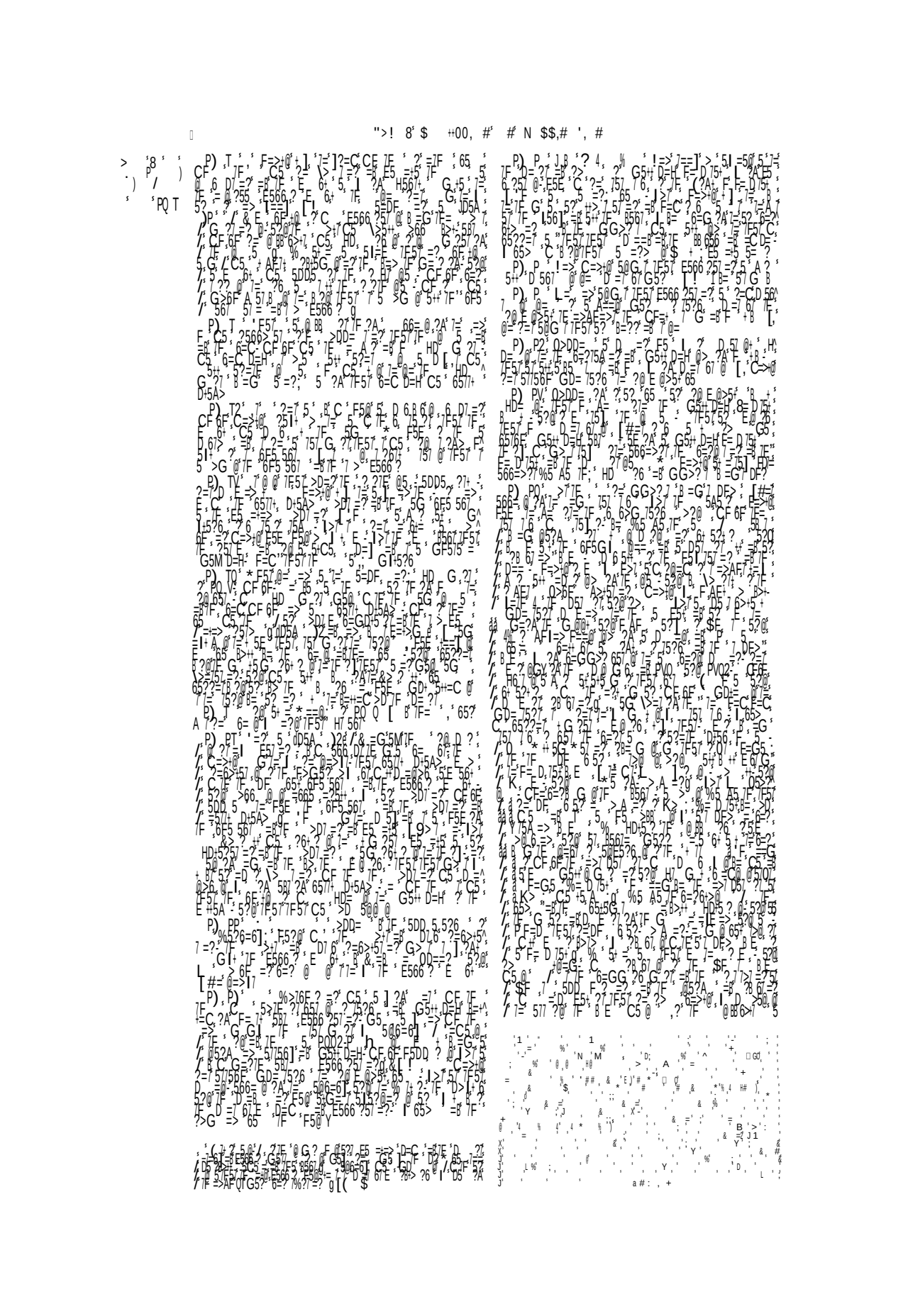

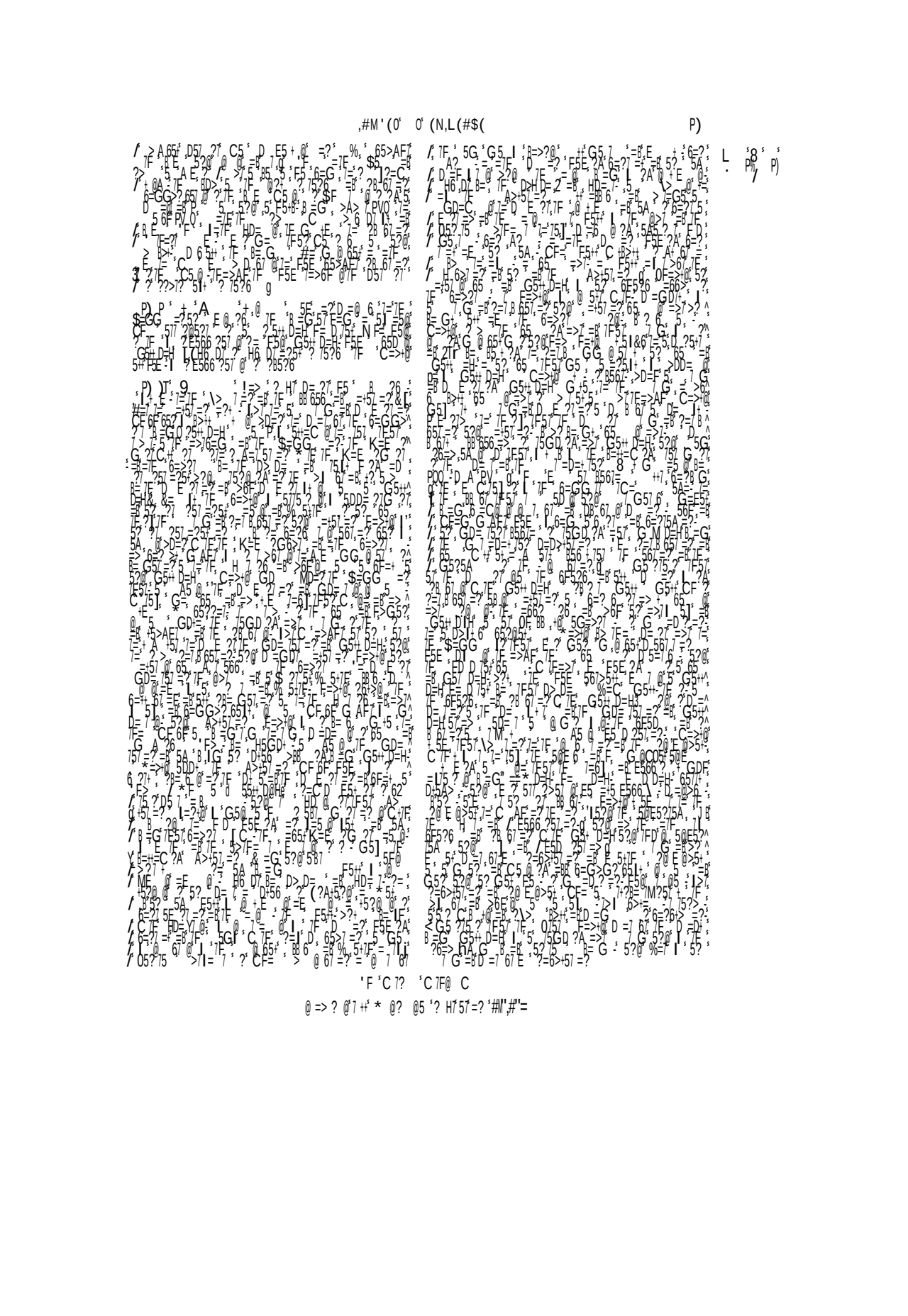

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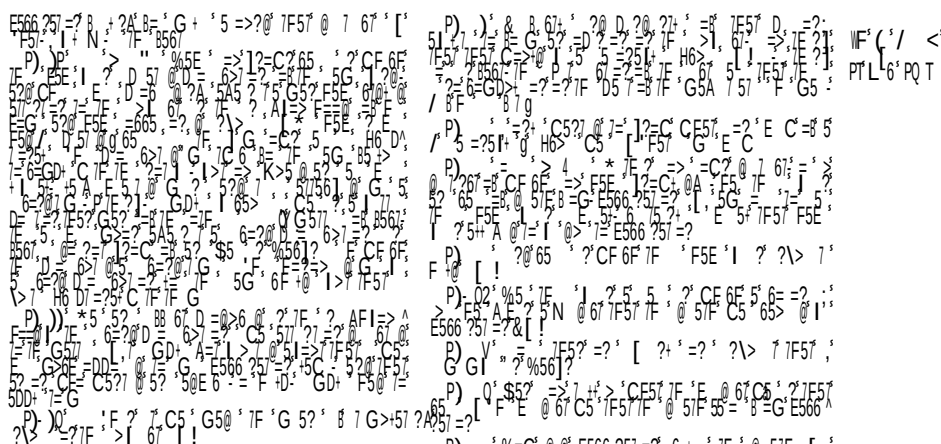
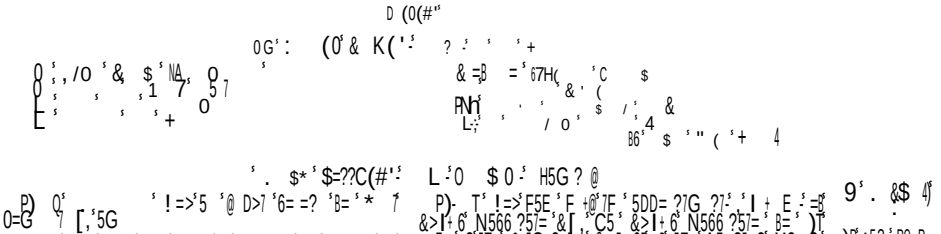


P)) ' & B 67+ ' ?@ D ?@ ?7+ ' =B' 7F57 ' D =?
5I+ ' 7 ' B= G ' 5? ' =D ? =? ' 7F ' >I ' 67 ' => ' 7F ?] '
7F57 ' 7F57 ' C=>+@' I ' 5 ' 5 =?5I+ ' H6> ' [' 7F57 ' 7F ']
' ?= 6=GD>+ ' =? ' 7F ' D5 7 =B' 7F ' G5A 7 57 ' F ' G5 '
/ B' F ' B 7 g
P) ' ' =?+ ' C5?7 @' 7= ']?=C ' CF57 ' =? ' E C ' =B' 5 '
/ ' 5 =?5I+ ' g ' H6> ' C5 ' ' F57 ' G ' E C
P) ' = ' > 4 ' * 7F ?' => ' =C ?' @ 7 67 ' = ' >
@ 7 ?67 =B' CF 6F ' => ' F5E ']?=C+ @A ' F5 ' 7F ' ' ?'
5? ' 65 ' =B' @ 57 ' B =G ' E566 ?57 =? ' [' 5G ' = ' 7= ' 5 '
7F ' F5E ' ' E 5+ ' 6 ' 75 ?+ ' E 5+ ' 7F57 ' F5E '
I ?' 5+ ' A @' 7= ' I ' @> ' 7= E566 ?57 =?
P) ' ' ?@' 65 ' ?' CF 6F ' 7F ' F5E ' I ?' ?\> 7 '
F +@' [!
P) 02 ' %5 ' 7F ' I ?' 5 ' 5 ' ?' CF 6F ' 5 ' 6= =? ' '
> F5 ' A E ?' 5 ' N @ 67 ' 7F57 ' 7F ' @ 57 ' C5 ' 65> ' @ I '
E566 ?57 =? & [!
P) V ' = ' 7F5? ' =? ' [?+ ' =? ' ?\> 7 ' 7F57 ' '
G G I ' ?' %56]?
P) Q ' $5?' ' => ' 7 ' +' > ' CF57 ' 7F ' E @ 67 ' C5 ' ?' 7F57 '
65 ' [' F ' E @ 67 ' C5 ' 7F57 ' 7F ' @ 57 ' F 55 ' = ' B =G ' E566 ^
?57 =?
P) ' ' %=C ' @ @' E566 ?57 =? ' 6 + ' 7F ' @ 57 ' ['
7F '] ' 7 C5 ' 6=?E> ' =? ' 6=?N> ' =D ' 5 ' ?A ' B =G ' E566 ^
?57 =?
P) T ' 4 ' $5?' ' => ' 7 ' +' > ' 5 I=> 7 ' CF ?' 7F57 '
C5 ' ' [' F57 ' C5 ' ?' PQQ ' (' ' 0E5 D ' 7F ?] ' C5 ' 7F '
?5G ' ' 65??=7 ' A E ' => ' 7F ' H567 @57 '
P) ' P ' $5?' ' => ' 7 ' +' > ' I B= ' CF57 ' 6= =? ' 7 ' =6 '
6> ' [' B= ' 7F ' @ I D> 7 ' 6= =? ' $=++
P)) ' ' ' %' * F57 ' C5 ' 7F ' 5A ' =B' 7F ' 6F +@'
[' 5G ' ?=7 ' D ' D5 ' @' 7= ' A E ' => ' 7F ' @ 75 ' =B' 7F57 '
65 ' ' 65??=7 ' 5 ' CF 7 7F ' 5A ' =B' 7F ' 6F +@' C5 ' 7 '
C5 ' E ' =>?A
P) Q ' ' > 4 ' ++ @7F ' 8=6I ' K=E ' 2G ?7 ' =5 @'
75] ' 5? ' D =6 @ ?A ' ? 6=? \> ?6 ' =B' 7F57 ' E @ 67 ' [
#=7 7I57 '] ?=C ' =B
P) ' ' @' 7F I ' ' ?@' @=C ?' 5? =? ' 7= ' ?\> ' ?7=
7F ' [#=7 7F57 '] ?=C ' =B
' ' # ' %% ' ' > %4 ' ' ! => ' F5E ' 5 @' 7F57 '
?' %56]? ' 7F ' 5I => ' ?A ' 6+5 ' ' => ' 7F => AF ' ' '
E ' G>6F ' =DD= ' @' 7= ' E566 ?57 =? ' & [' F57 ' G ' H^
D ?6
P) ?' ' = ' => ' 7F ?] ' 7F ' 5 ' G= ' =DD= ' @' 7 & ' 7
7F57 ' 7F ' 6+5 ' C I 6F ' =G ' 7 G ' D=] ?' =B' 5 ' G5+ '
aa 7 5@ ' G ?' ' [' F ' G5+ ' 7 5@ ' G ?' 5 ' E ' G>6F ' =B'
7F ' 5G ' =D ?' =?
P) V ' 7 => ' C=>+@' ?= 7 @ ' 7 ?A> ' F ' I 7C ' ?' 7F ' 7C5 '
$+ ' ' 7F57 ' D 67 & [#= ' ' F => @ F5 @ ' 7 ?A \ ' F '
I 7C ?' 7F G



@ => ? @' 7 ++ ' * @? @5 ' 7F)P 7 =B' :5?>5 ' PQ P ' 57 ' P =6+=6]

WF (' / <'
PT L 6 ' PQ T

'$ 20 "# % /

: % 0% ' E 0 ' 7 . ! '

D (0(#'

0G ' : (0' & K(' ' ? ' ' ' +

0 ' , /0 ' & $ ' NA 0 '
0 ' ' ' 1 7 ' 5 7
L ' ' ' 0 '
L ' ' ' +

& =B = ' 67H(' C $
& ' (
PNH ' ' ' $ / ' &
L ' ' / 0 ' ' 4
B6 ' $ ' " (' + 4

' . $* ' $=??C(#' ' L ' 0 $ 0 ' H5G ? @

P) 0' ' ! => ' 5 ' @ D>7 ' 6= =? ' B= ' * 7 '
0=G 7 [' 5G
P) ' ' ?@' E5E ' => ' I ' ?' ?' D 567 6 ' B= ' ? 5 + ' T '
5 ' > B6 ' T 5 ' 7F ' 5
= 2 T T

P) T ' ! => ' F5E ' F +@' 7F ' 5DD= ?7G ?7 ' ' I + E ' =B '
&>I + 6 ' N566 ?57= ' & [' ' C5 ' &>I + 6 ' N566 ?57= ' B= ')T '
5 ' ?' 7F ' & 7G ? ' ' @ 7 67 ' =B' 7F ' ' 5>?7=?' M? =? '
5?@' B= ' E ?' 5 ' =B' 7F57 @ 7 67 ' 6=? = ? @' C 7F ' 7F
<

9 ' . &$ 4)
' '
)P ' :5? ' PQ P

7F ' GD= ' 1 7F ' + E @ C 7F 5 ' ' $5G = ? ' ? '
=B 7F= G ? E5@ L ? E566 ?57 @ 5?@ 7F = ?F ' E5@
?=7 7F L =7F F5@ G5++ D=H 5?@ 7F = ? ' CF= F5@
L ? E566 ?57 @ F5@ G5++ D=H G>6F G= ' E +
7F5? 7F = ? CF= F5@ ?=7 L ? E566 ?57 @
P) VT ' * ' 7F= ' 7C= ' =B 7F ' 7 [#= 7F ' C '
?6 @ ?75 65 ' 5?@ 7 F5@ ?=7F ?A 7= @= C 7F 7F ' 65 '
C5 ' B ?A 7=
P) VT ' ' 9 <4 % ' ' >?@ 75?@ 7E5 7F ' E @ ?6 '
= ?F5E ' A E ? 7= 7F $=GG = ?7= @5 @ 5C? B =G '
=M D =?5 HD ?6 !
P) VT ' %5F ?A L ? B= ')T ' 5 ' ' &>L+ 6 N566 ?57= '
5?@ F5E ?A HD ?6 @ 7F D @ G 6 = B G5++ D=H '
[!
P) VT2 ' 7F ?] ' => ' 7 ++ E=+@ = BB 6 5 D= 7 = ? ?
= 6 =?7 ' [5G D 567 65++ 6= = ? B= 7F C 7 ?
@ E = ?B= ' 5+ 7F=>AF @ D>7 - 7F 6= = ? @ 5L+ @ -
5?@ , @= 5++ F C=]
P) VTV ' ' >?@ 75?@ ' => ' N C ' >D= ?E566 ?57 = ?
5F ' >?@ A= ? 6F5?A ' V 7F5@ ' ?= E C ' >D= ?
E566 ?57 = ? ' 566 D @ E566 ?57 = ? 5 ' L ? A = 7F= @=H
? 7F D =B = ?7 ' C5 D5 7 = B G @>7 ' 5 7F D>L 6
=B 6 7F E566 ?57 ' L>7 5B ?A 7F D @ G 6 = B
G5M D=H F5@ L 6=G GD @ C 7F 7F 6=?E 67 = ?
7F5 E566 ?57 = ? C5 ?=7 D E ?7 E
P) VTO ' D75 7 ?A C 7F ?= E C ' L>F5E ' 6=G L ' 7= 5
= ? >7 CF 6F = DD= ' 7= 7F ' BB 65 = B N566 ?5
7 = ? [! B => ' L ?A E => ?A 566 D7 @
7F E C CF 6F C ' A ? 5++ F +@ 0= 5 = ?A 7 G
@ ?=7 A E C5 ' 75AA @ G 6 75 ?= ' L>7 '
F5E ?= D ' ?@ 6 ' 5G ?=7 5?@ E=65 7F ' =? =?
@ ?=7 5 D E ?7 E = B G5++ D=
P) VT ' %5E ' => E ' L ? 6=?? 67 @ C 7F 5D ' 5?7 ^
E566 ?57 = ? = A5? 57 = ? & [# E ' E=>@ 6 = ?
E=+@ 5? D ' >@ 6 - 5?@ 5++ 5?6 = B 7F5 7] ?@ ' 7F ?] -
5 ?=7 > 75 L+
P) VPT ' +7=A 7F ' ' 7F ?] ' >?@ 75?@ ' => ' 7= 5 '
7F5 7 => F5E ? L 7C ? TT 5?@ 2TT 65 = B G5++^
D=H [! D= L+
P) VPP ' B 7F= ' ' >?@ 75?@ ' => ' 7= 5 ' 7F5 7 ' =>
5 6 75 ? 5 7 5 7 ' 7= L E566 ?57 @ [! ' F=>+@
7F ?] 5 A= @ 5 G= 7F5? 7F5 7
P) VP ' %=C G5? ' BB @ => ' 5 6 75 ? 7= L ' >?E566 ?5^
7 @ L @ @ ?= 7 5 6 75 ? 7F ? G L 5 5++ 7 ' 7 5 7
7F5 7 D 56 65++ ? 5 5 ++ C E566 ?57 @ E B C
D =D+ 65D E566 ?57 = ? ? 5>?7=?
P) VP ' * E ? => G5 ' 7F5 7 7 G ? 7F5 7 E B C
6 3D ? 5>?7=? 5DD E ? 7F5 7 F5 @ 5DD+ ' 7
7F 5 Y PQ Q CF ? 7F B 7 D @ G 6 = 6 6> @ [#=
7 C=>+@ ?=7
P) VP ' ' F5 7 C=>+@ F5E ' L ? L B= ' 7F ' B 7 6=G^
D>+ = ' +5C = B PQ [#= @=>L7Y
P) VP ' L => ' 7=+@ 7F ' $=GG = ? 7F ' @ 75 + ' = B = ? '
>?E566 ?57 @ 65 ' 7F5 7 = B 5 A ?7 G5> ' *F= F5@ 7 @ 5?
57 6 + 5 [5?@ 5 7F5 7 = ? 7 B ' F L 7C = 06 = 7F
A ?7 G ? E ?A C 7F ' 5G ? 7 ' L => = 7 ' =
= $5G = ?7 5 ' 7 5?7 ' 7 E ? ' F => = ? = B
CF=G E5@ L ? E566 ?57 @ 7= 7F ' (H7 ? = B 5 7 D 65
65 ' 7F5 7 G5? F5@ G5++ D=L 5?@ 7F = 7F B CF= F
? E L ? E566 ?57 @ F5@ G5++ D=H 5 = L>7 F CF=
F5@ ? E L ? E566 ?57 @ F5@ G5++ D=H + AF 7 CF +
F CF= F5@ L ? 7 D 65++ E566 ?57 @ F5@ B7 E 7 F
P) VP2 ' $=>+@ ' => ' 7 ++ > ' 7F ' @ 75 + ' = B 5? ' = 7F '
??E56 ?57 @ 5 L ' 7F= S#= ' @= ?=7] ?=C
CF 7F ' 65? ?=C 7 ++ => = B W5
P) VPV ' $=>+@ ' => ' 7 ++ 7F ' $=GG = ? = B 5? ' >?E56 '
?57 @ 65 ' = B G5++ D=H CF 6F 7 G ?57 @ B5 75++ ' 5
#= L 65> ' 7 = ? E5 ' 7 E566 ?57 @ 5 G>6F 5
F F5 L ? 6F 7 ? @ C 7F ? +57 = ? = 6F 7 D 56^
7 65++ ' 65D E566 ?57 = ? > 7 75 ? A B= ? 75?6 '
7F 65 = B 6F +@ ? CF= F5@ F @ = 6 DF5+> ' ?=? = B
CF=G =>AF 7 = L E566 ?57 @ 5 G = 7 = 5 7F5 7
F5E ? 6 G 7 G ? 7F = 7 5 = E566 ?57 = ? ?
7F5 7 @ 6 G ?57 = ? 5A5 ? 7 E566 ?57 = ? H 6 @ CF 6F
=>AF 7 = L F 7 G D 57 = ? 7 = L 5G G=? 6 F5D
5 7 F5 7 ? 6F 7 ? @ C 7F ? +57 = ? = 6F G 6 = B G5++^
D=H F5E ? E ? 6F +@ ? CF= F5@ F @ = 6 DF5+> '
= D= L+ F D @ 5 ' 57 56] @ L G 6 D=H
P) VPO ' ' >?@ 75?@ ' => ' 7 = 5 C5 @ 7 ?6 7 = ? L 7C ? '
/ ' >66 B> g E566 ?57 = ? E 7F ? 5 HG @ 7 = @ L '
= 5 @ = B K>5 @ 5? 5?@ 7F5 7 / D5 7F = = A 65 Y E566 ?5^
7 = ? 5 ' => 7 G @ 7 CF 6F D = @>6 @ G5+5 ' ' ! '
P) VP ' $=>+@ ' => ' A E ' G ' 5? ' @ 5 CF5 7 D = D= 7 = ?
Y= B / >66 B> g E566 = 57 = ? ? 5? = BB 6 5 ? C=>+@

L ' / D5 7F = = A 65 ' E566 ?57 = ? ' ? => Y ? ' & [' B E ?
G= 7F5? F5+B = B 7F G 6 75 ? + ' 65D ' 5? ' @ 7 > 15?6 9 ' . &)
= B 7F 7 G
P) VT ' * E 5 ' ' >?@ 75?@ B = G ' => ' 7F5 7 ? = ? = ?
? TT E566 ?57 = ? B5 + 7 = L ' / >66 B> 7 @ ? 7F = BB 6 5
? [#= ? = ? ' TT 6 75 ? + ' D = 15 L+ ' ?= 7 = ? ?
TT 1 7F F5 @ + ' E B5 +
P) VP ' L = ' => ' G G L ' 5? ' D5 7 ? 7 ' E566 ?57 @ L '
=> ' 7B CF= ' >L 7 > 7 ' >BB @ B = G ' G5++ D=H 7 ' 7
5G 7 > 7 > 7F5 7 CF ? ' F5@ 7F = 7C = @ 7 67 ' 5?@
5 5 A D E5 7 D 567 6 ' 5 A 5 7 ? >G L ' = B 7F = ' E5
6 75 @ E5@ G5++ D= = B 7 C5 @ ' L>7 @ = 7 G 7 G
7F = 5G 0 ?A ' F5E L ? = 7 = B A ? 5 D 567 6 '
F5E ? 7 E ? G 6 5 ' L = 5 ? 5 ? 7F = ' G G = 5 ? @ 5 '
F5E ? = 7 E ? G 6 5 ' L = 5 7 F5 ? @ ' GD+ 75] B '
P) VV ' L = ' => ' 7F ? ' => ' 6 => + @ 7 56 ' 7F ' D= 7 E5 = ? = '
G5++ D=H ? 5>?7= ? 7 = 7F E566 ?57 = ? F5E ?A L ' 7
@ = ? 5 G5? ? ' 7F5 7 C5 M ? 7 D 65 = ? 5 7 B 567 = ' L '
' 65 ? ? = 7 ' L>7 = ? C5 = B E566 ?57 = ? 7F5 7 '
CF 7F ' D= ?7 ' 7 ' 5 @ = G 7 G ' 7F5 7 ' 5 7 5 7
?>G L = B D>?6 ' 7 ' F=>+@ L ' 7 @ ' L> 7 ' 65 ? ? = 7
HG @ 75?@ 7E5 7 E5 7 F=>+@ L ' L 65> ' ? ' L ' 7 = B 5
6= L 5 C ++ ? E ? = G 5?@ = F DF 7 D = ? 7 C ++ ? @
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B 7 @ = ' ?= 6>?5 7 ' 5 7 5 ++ L>7 = B 6 = > 5 E5 ? ? >G L '
= B L G5 = 6 6> ' C 7F => 5 L B= ++ = C ?A C=>+@ L '
5 BB 67>5 5 B 7 C B = G 7 C ?7 D>?6 7>
P) V ' D5 7 B = G 7F5 7 7F = ' @ @ ' => B ? @ 7F5 7 7F '
= ? ' 8 = B G5++ D=H ? 5>? 7 = ? E5 @ 5 7 5 ++ 566 = @ ?A
7 = 7F ' ?>G L = E L+ 7 = B 7F G5] [' @ @ ?=7
?=7 6 7F5 7
P) V ' L @ ' => ' D5 ' 577 ?7 = ? 7 = 7 + 5 7 D= ?7 ' J+ @
?=7
P) V ' L @ ' => ' ' ?>G => ' G5] ' = B E566 ?57 = ?
? B = ? ' >BB ?A B G G5++ D=H [E ' = @ ?5 '
?>G L ' ? E566 ?57 = ? C=>+@ L 7F G5] ' = F5E '
7 5 A 5 7 ?>G L >BB ?A B = G G5++ D=H C 7F >6F
G5]
P) V 2 ' L + E 7F ' 5 ' D ?7 @ ' >+ ' 5 ' 7F ' ?=7 '
B= 7F ' A ? @ 5F = = B & >L + 6 N566 ?57 = ' [#= 7 D G
7 G ' 5 ' D 567 65++ E566 ?57 @ 5 7 ' 7F ' E ' 6 ' 65 G
7 D 65 ' 5 ? @ 5 7F =>AF @ @ 7 = ' + ' >D= ? = ? E 6 ' 6
7 G ? B ? C=>+@ L 7F 7 = ? D 65 ' E ' 6 ' C=>+@
5BB = @ 5 G>6F D = 7 6 7 = ? 5A5 ? 7 G5++ D=H 5 ') T C=>+@
P) V V ' $=>+@ ' => ' 7 ++ G ' CF 7F ' 7F ' > ' = B 7F '
6 ? 65 7F G = G 7 ' L> 6 = G & >L + 6 N566 ?57 = '
7 = F C CF ? B E ' 5 = 6 = GD5D E5 G 5 7 = L [#= 7
5 7 5++ 5 ? @ ' @ = ? = 7] ?= C 7F5 7 C=>+@ L G>6F >
P) V O ' L = ' => '] ?= C 7F ' => 6 ' B = G ' CF 6F 7F ' GDF
C5 @ ' E @ CF 6F C5 ' GD = @ [' @ = ? = 7] ?= C '
5 C5 ' 7 = =] 7 B = G 6F +@ 7 = 6 +>+@
P) V ' ' ! => ' @ = ? = 7] ?= C 7 ' G = 7 ' = A F [' @ =
?= 7 ' F5E F 5 @ 7 5 ? 7F5 7 7F5 = E 5 => 6 ' L > 7
E5E ? = 7 A = ? 7 = 7F5 7 E5E ? = 5 @ = G ' L =]
CF 6F F5E L ? 7 5 7 D >L + 6 @ 7 F = 5 @ = G ' L =]
& = B = $ = = L F5 ?] ' L =] ' BB 65 ' 7F ? ' E ' '
D = 15 L + B 6 = GD ' G5? ' ? >G L ' = B 7F ' 7F ? A
CF 6F F5E L ? D >L + 6 @ ' F => + @ ?= 7 65 ' 7 = 5 @
E ? B 7F C D >7 L B = G
P) V 7 ' L = ' 7 = + @ 7F ' $=GG ' = ? = B 5 ? >G L ' = B
? 7 ' 7 ?A HD G 7 ' G5@ L ' = M 5 ' 5 ? 7 C 7F
A5 @ 7 = 7F ' ?= 6 > 5 7 ?A = B E566 ? ' 7 7F ' 65 ' = B 7F
65 7 + @ ' [#= 7 = ? ' L G 5 ' 75 ? 7 C G5@ 5
7 5 ? B ?6 ' = B E566 ? G5 7 = 7F ' >@ @ = B 5 6 = C 7 L > 7
7F 6 = C G AF 7 F5N ' 7 M @ ' ? 5 ? >?E 5 7 L 7 5 7
L > @ 5 ? = = ? C5 ? 6 = ? 7 ? C 7F 7 G 7 5 7
L > 7 = ? C5 = C 7F 7F ' >? ? > @ ' = B 5 F B '
C=>+@ 75] 7 5 ? @ ' B=>? @ 7F5 7 ? ? = ? 75?6 7 C= ++@
75]
P) V P ' * 5 ' 7F ' @ 5 ' C 6F C5 ' D E5 + ? 7 5G = ?A
7F 65 7 + ' 65 7 + D+5A> = D + > = D ? >G = ? 5 [' C5
D + > = D ? >G = ? 5
P) V) ' 7 C5 ' D > 7 7 = ' => ' L ' 7F ' F = ? => 5 L + ' $F5 G5 ?
CF 7F = ' 5 C 5 ' 7F5 7 5 ? = ? ' CF = F5@ 65 B >++
? F 7 A5 7 @ 65 7 + D+5A> 5 ? @ E566 ? 7F = >AF 7F ' C5 '
5 ? 6 = ? 7 = ? L 7C 7 7F ' C = 5 ? @ => 5 ? C @ # = '
[@ = ? = 7] ?= C CF 7F 7F L + E @ 7 = L > 7 7F C '
>6F E5A> @ 5 ? 7F D >L + 6 G ? @ C 7F B ?6 7 = '
E566 ?57 = ? 5 ? @ 7 ? 7 5 ? 7F5 7 7F ' C5 ' 5 C F B = '
HD G ? 7 = L G5@ 5 ? @ 7 = ? @ 7 = 7 = ' 5 C
6 = >+@ ? = 7 D = E 5 ? L + 5 7 = ? F D 5 ? @ ' @ @ ? = 7 L + E '
? 5 ? 5 7 = ? F D L > 7 G5@ 7 = ? = D ? = ? C5 7F5 7 7F = '
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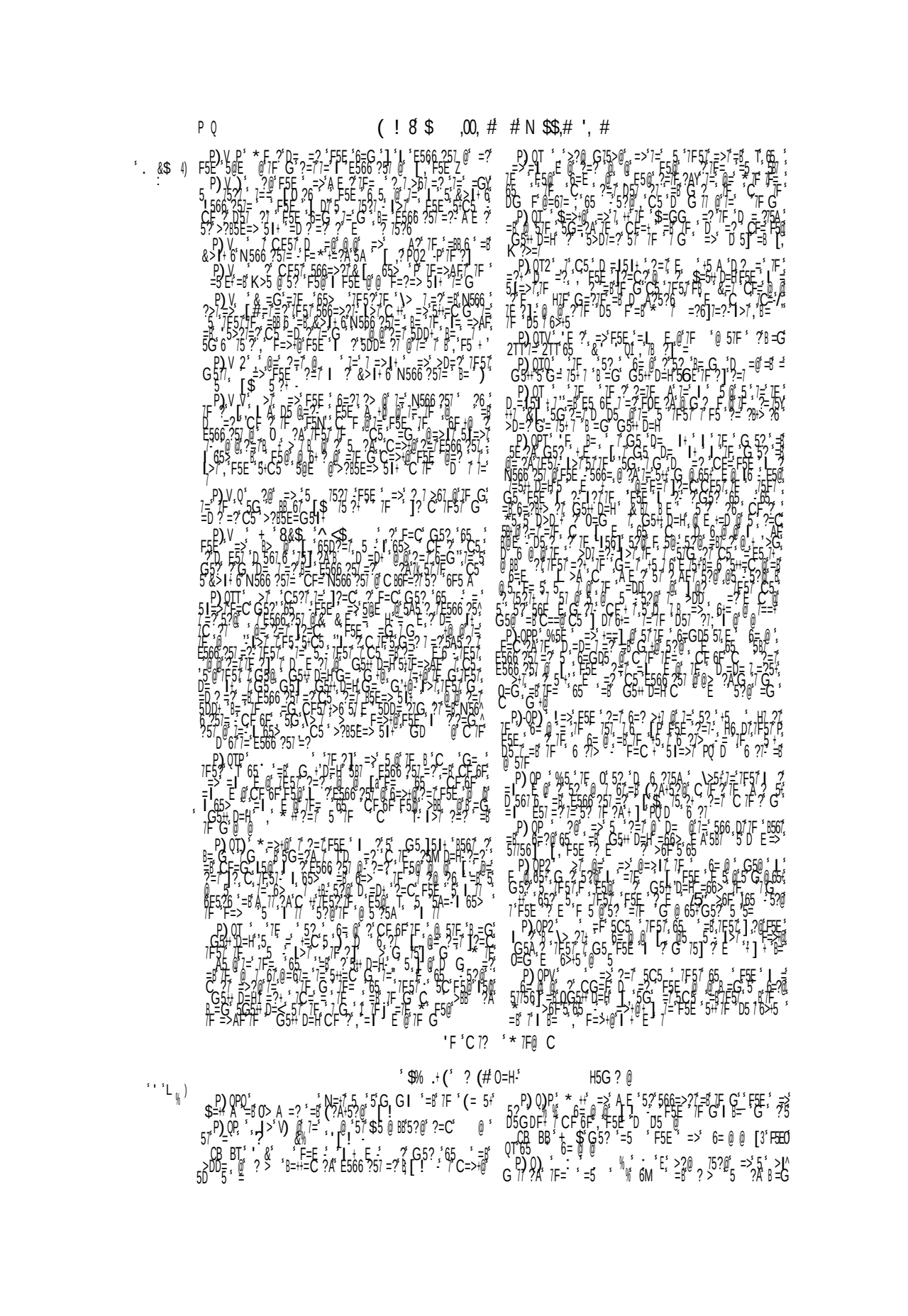

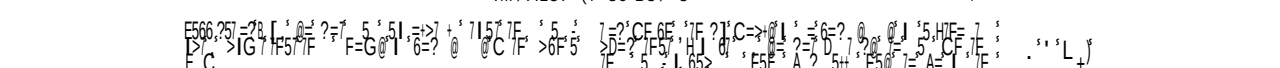

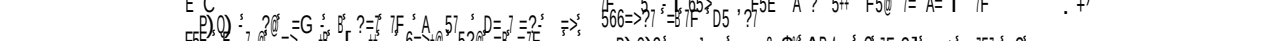

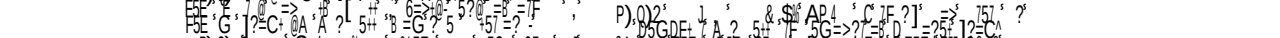

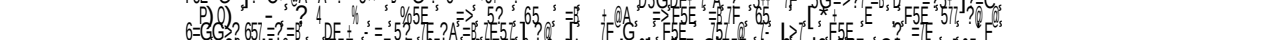

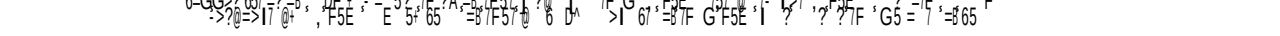

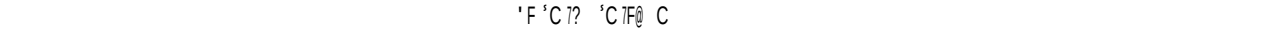

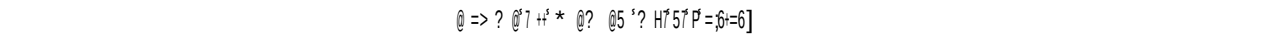

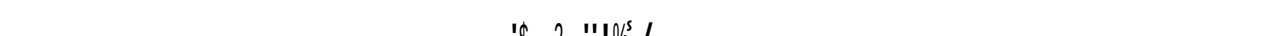

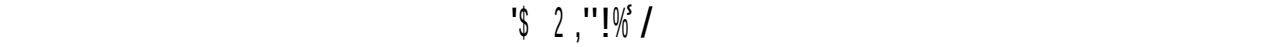

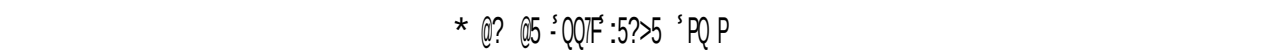

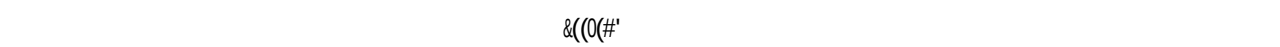

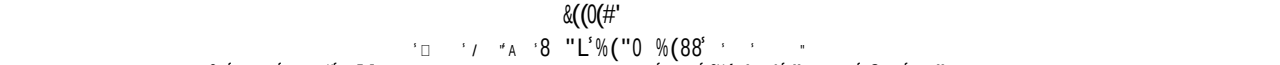

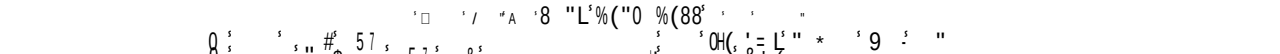

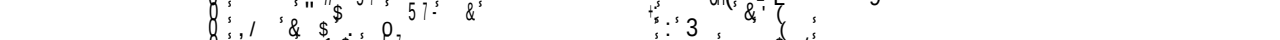

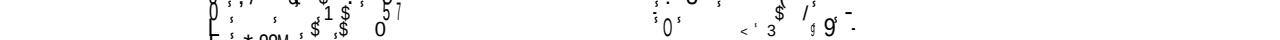

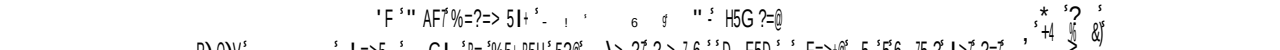

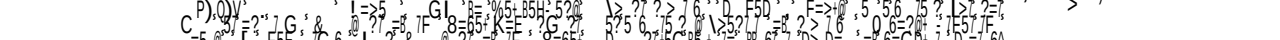

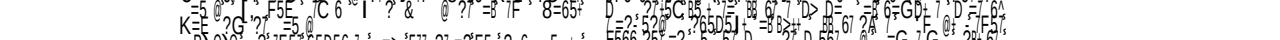

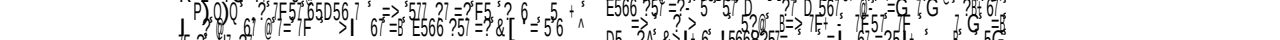

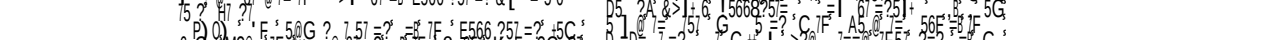

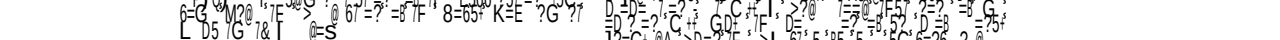

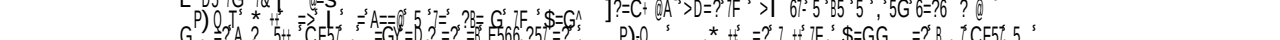

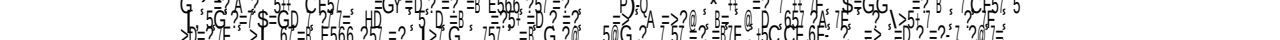

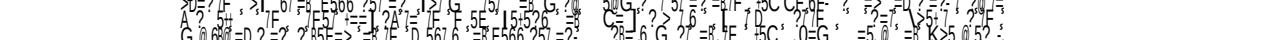

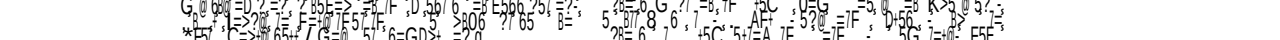

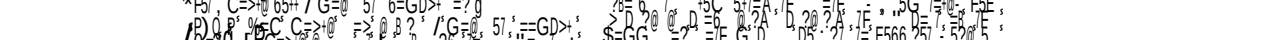

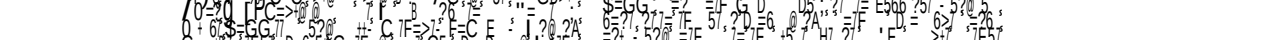

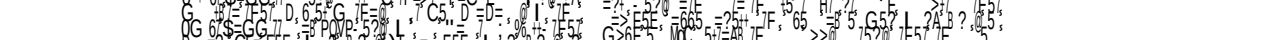

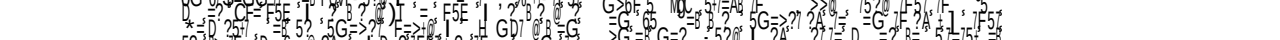

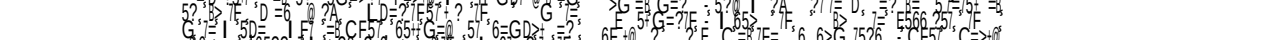

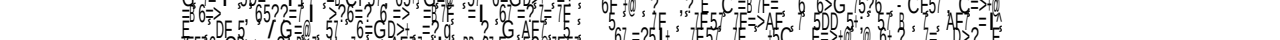

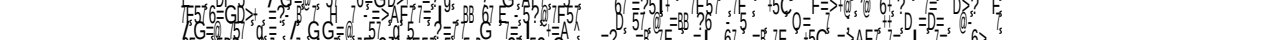

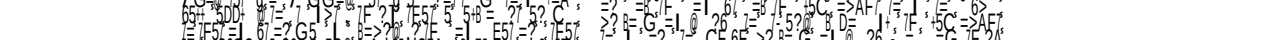

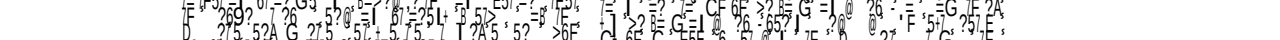

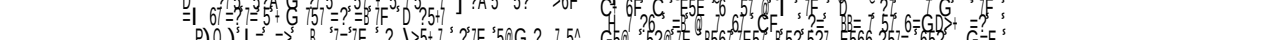

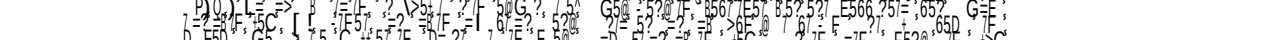

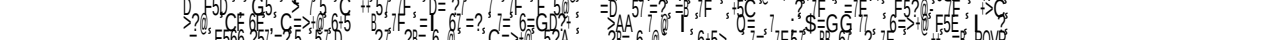

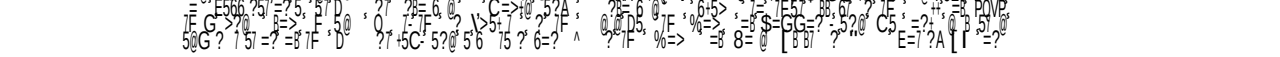

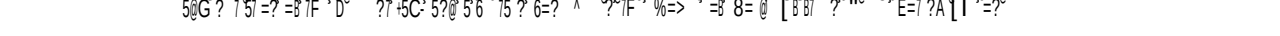

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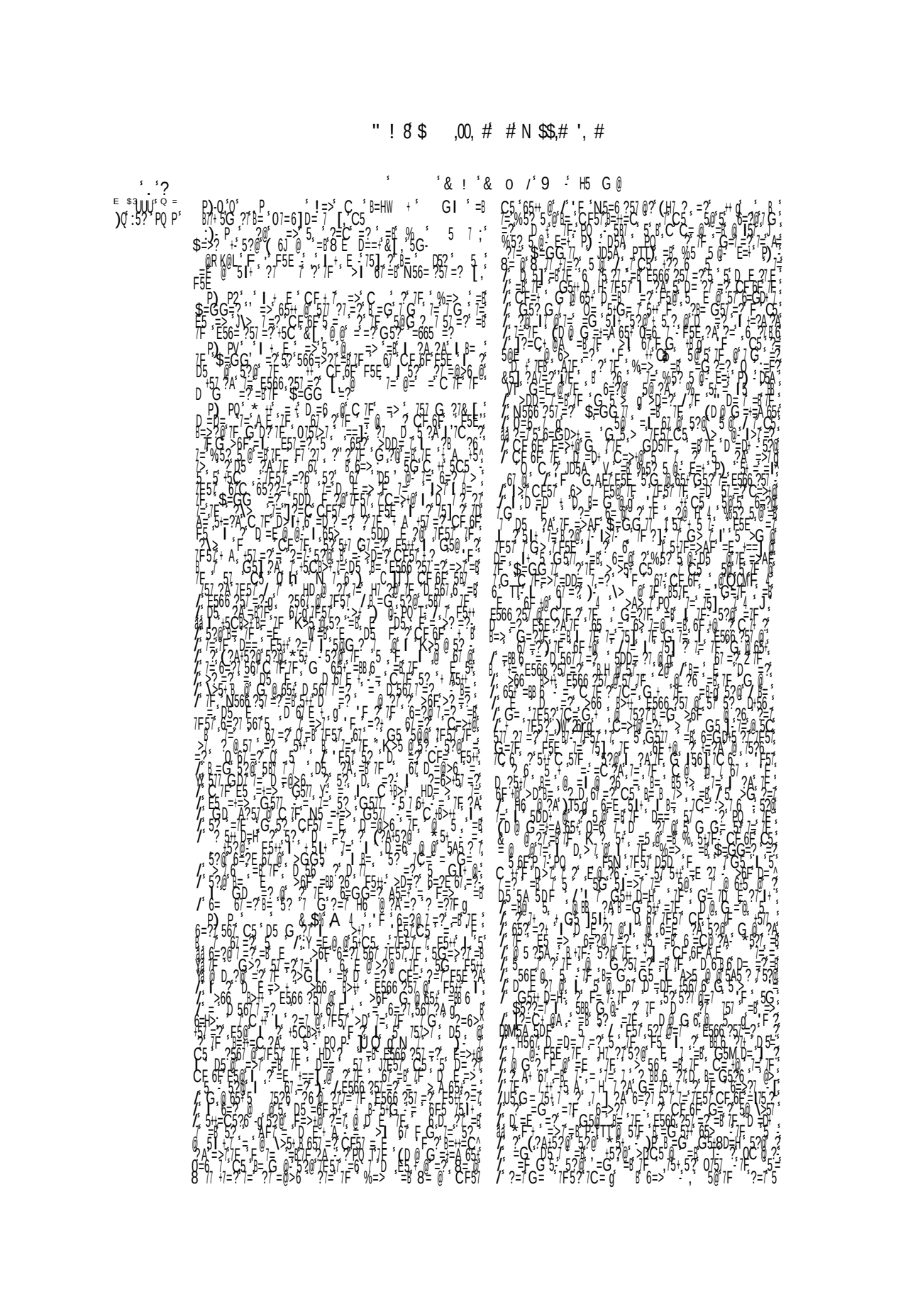

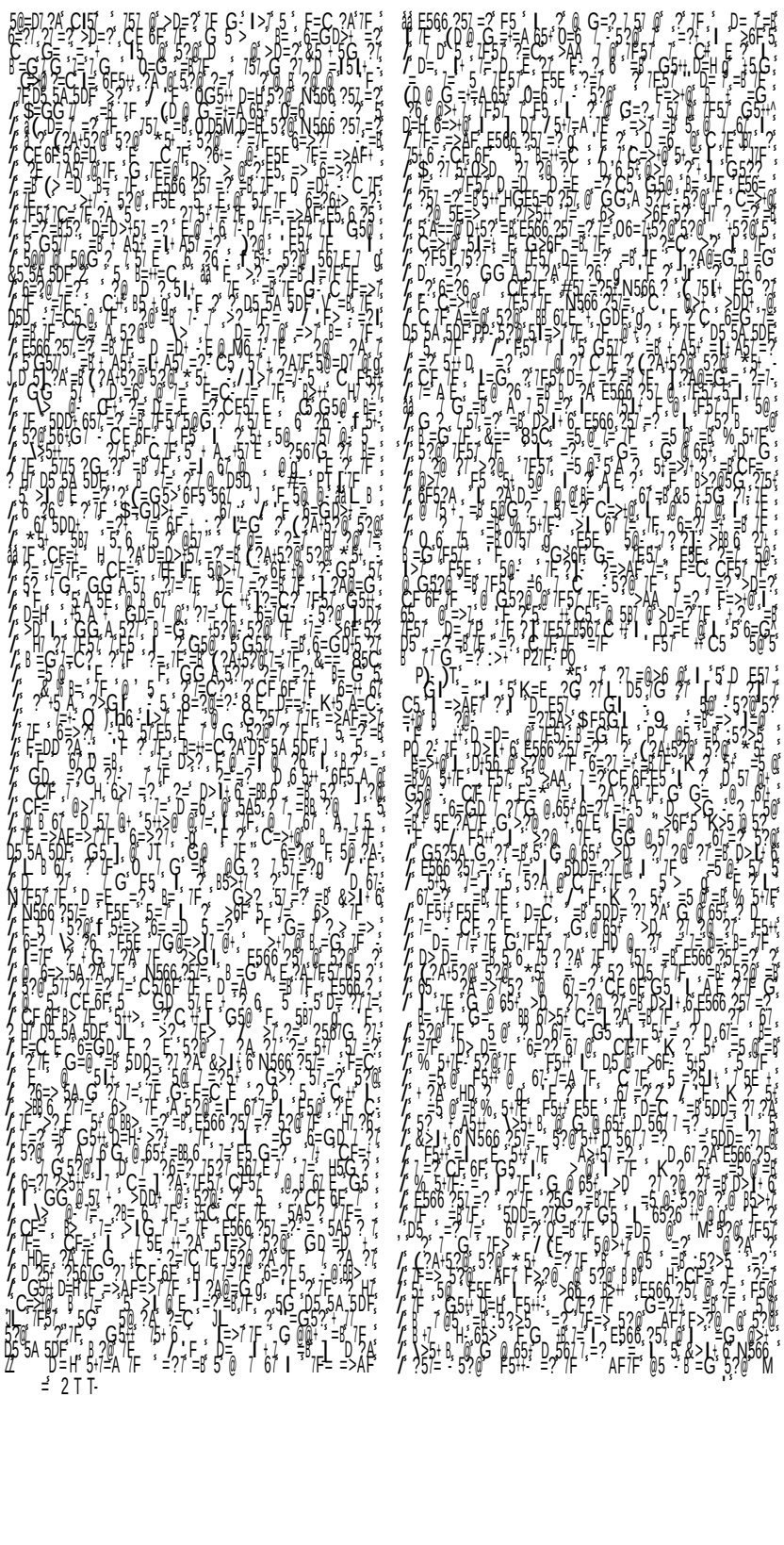

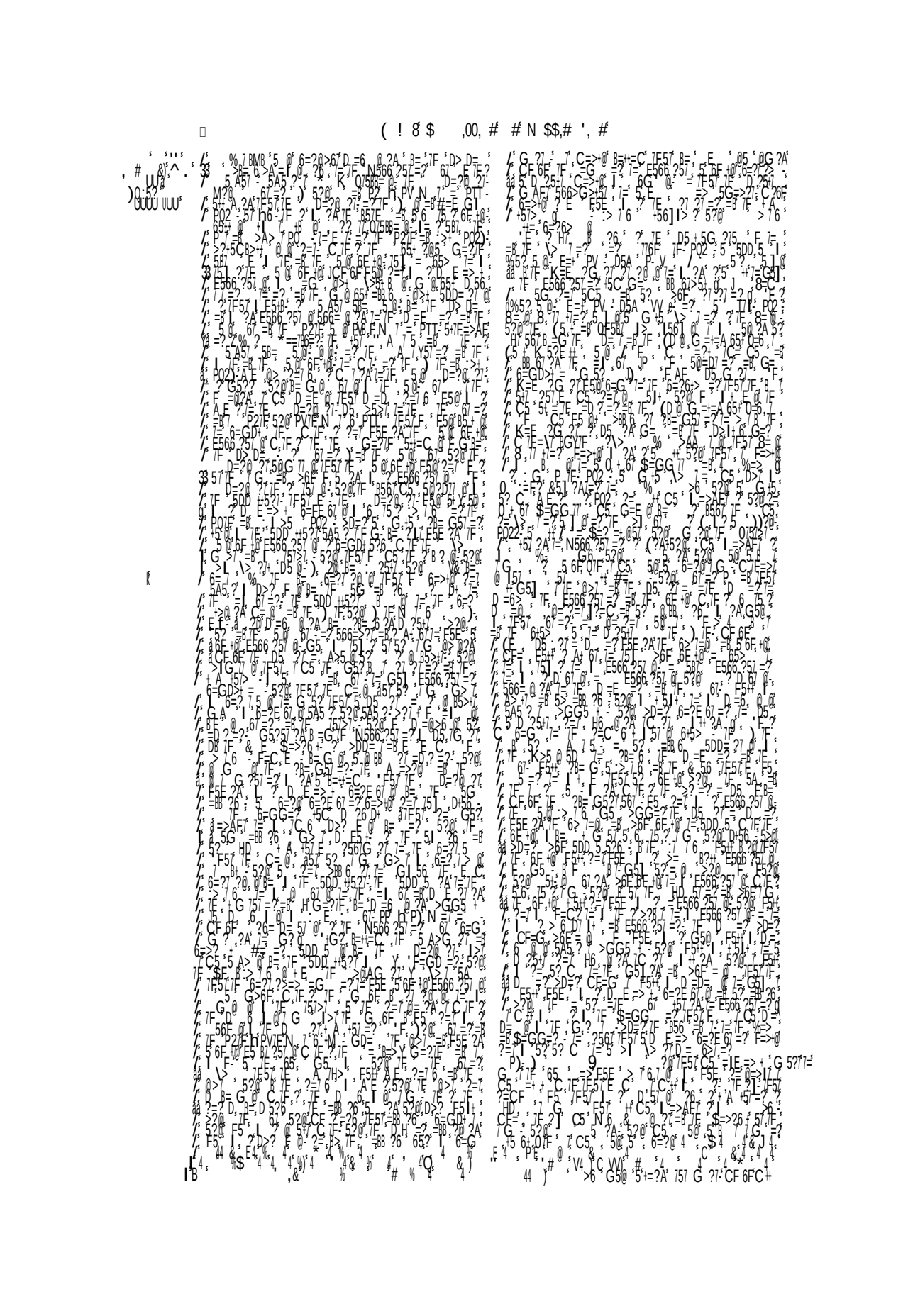

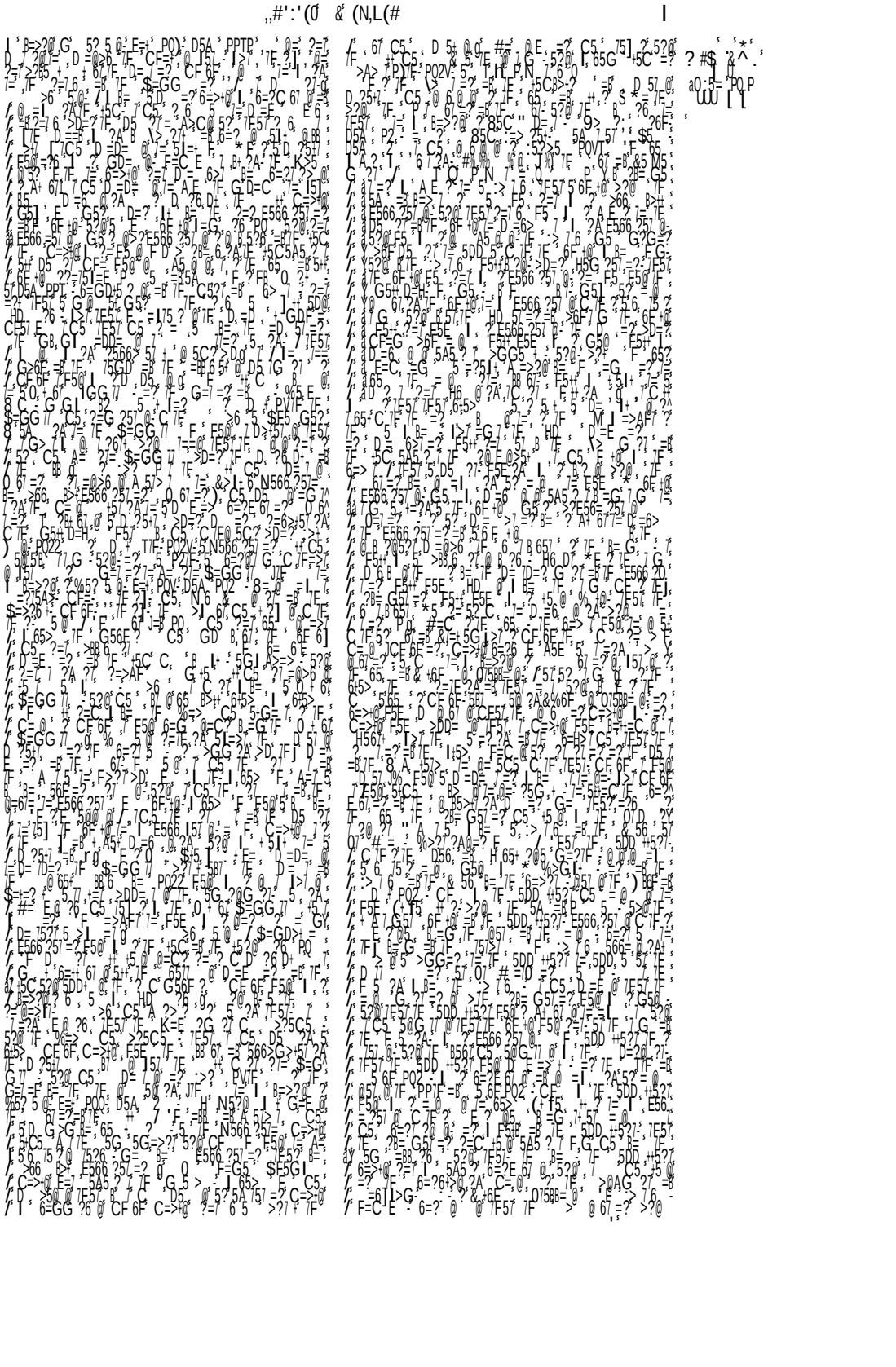

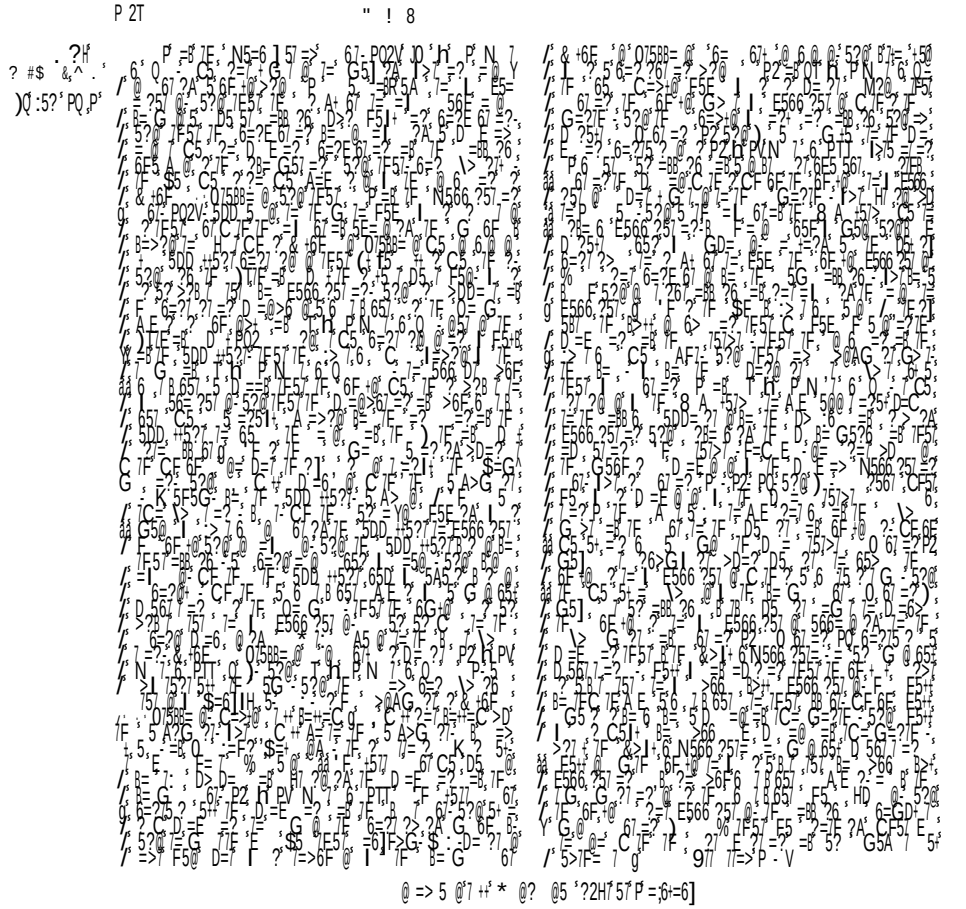

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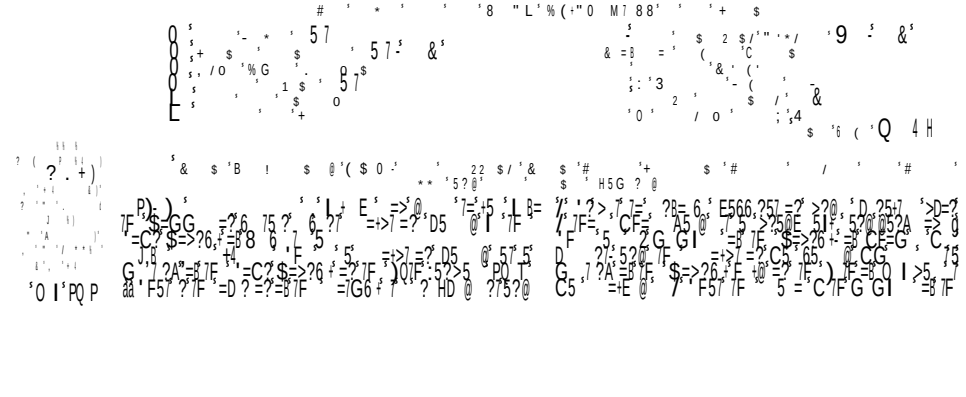

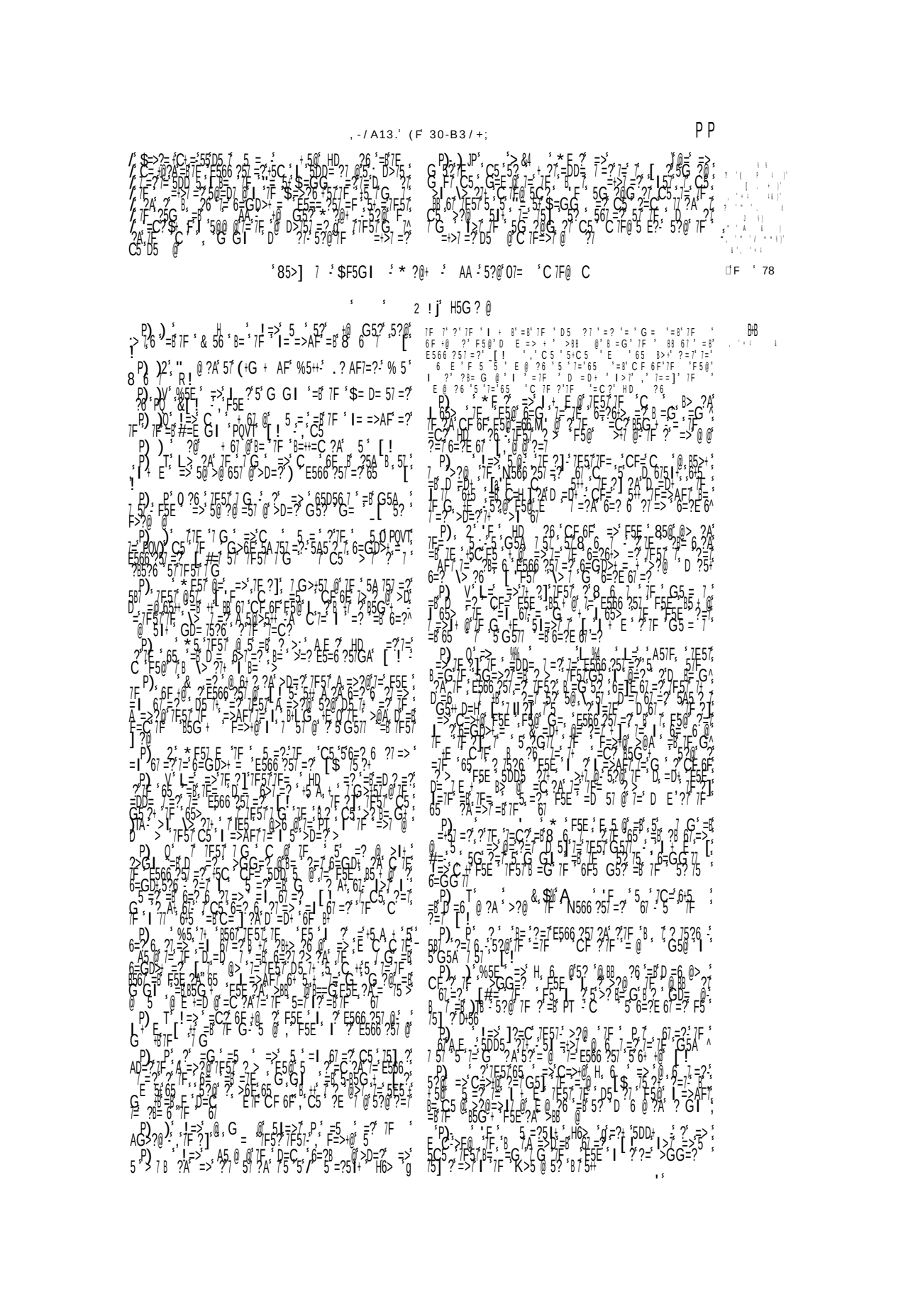

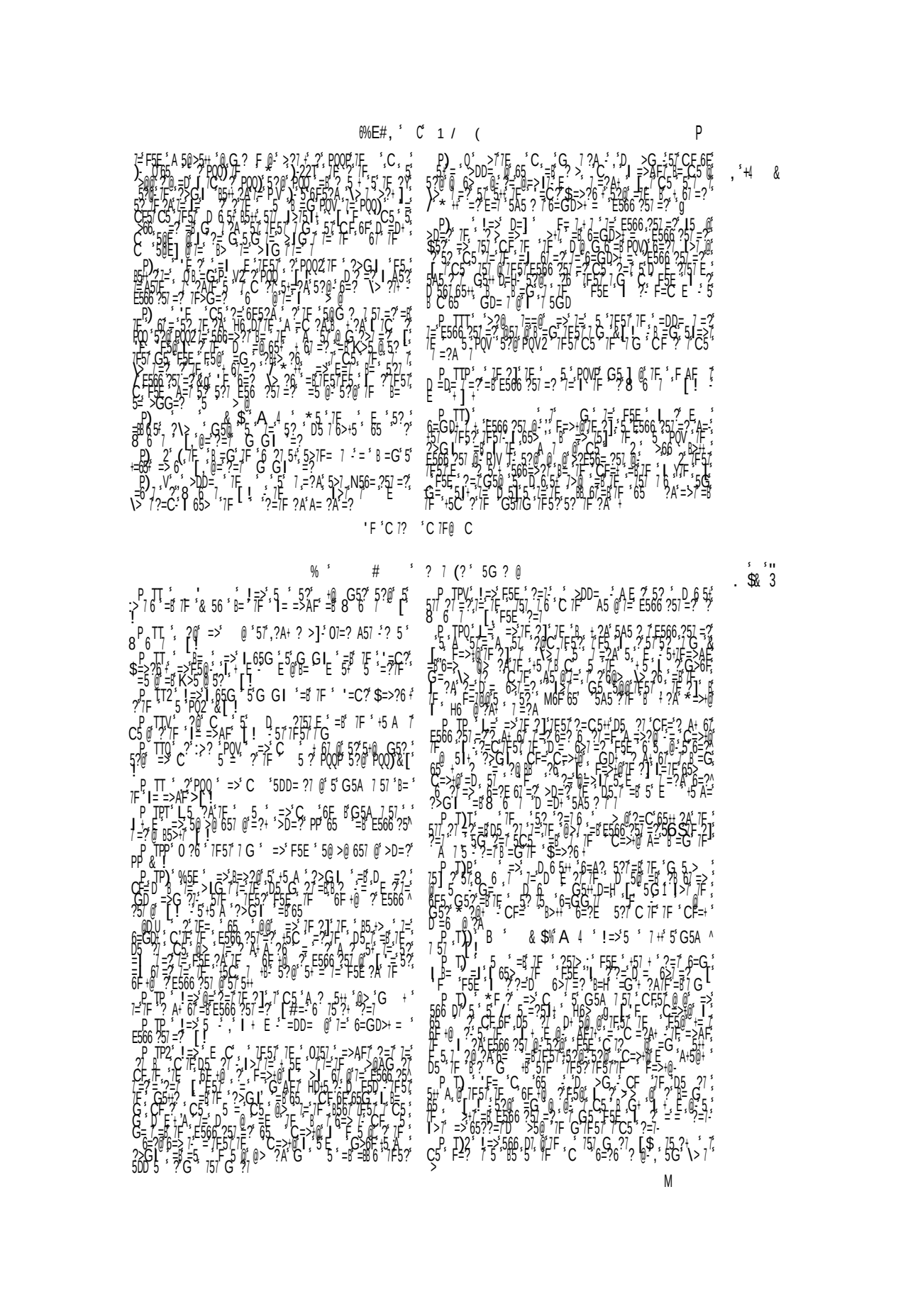

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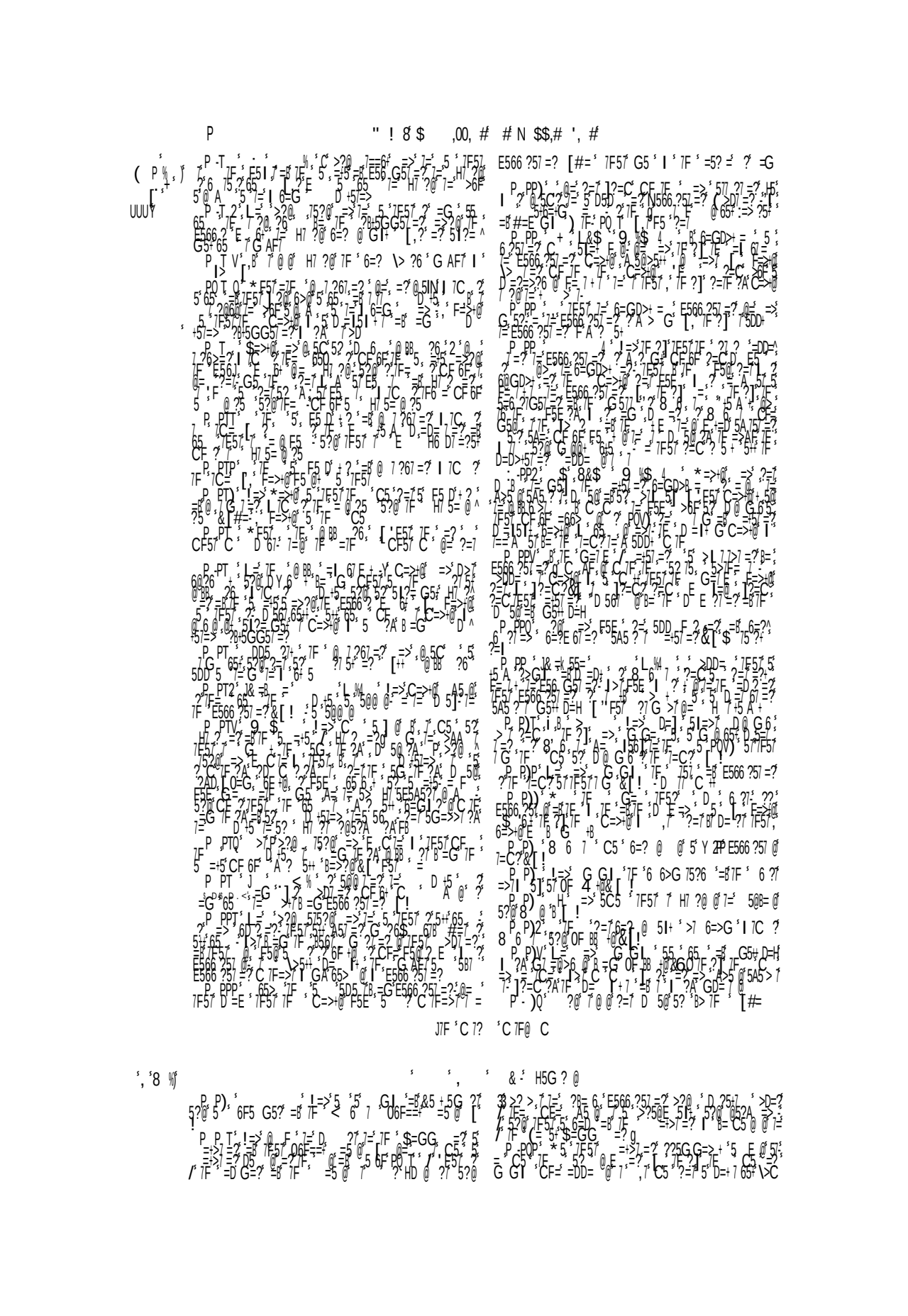

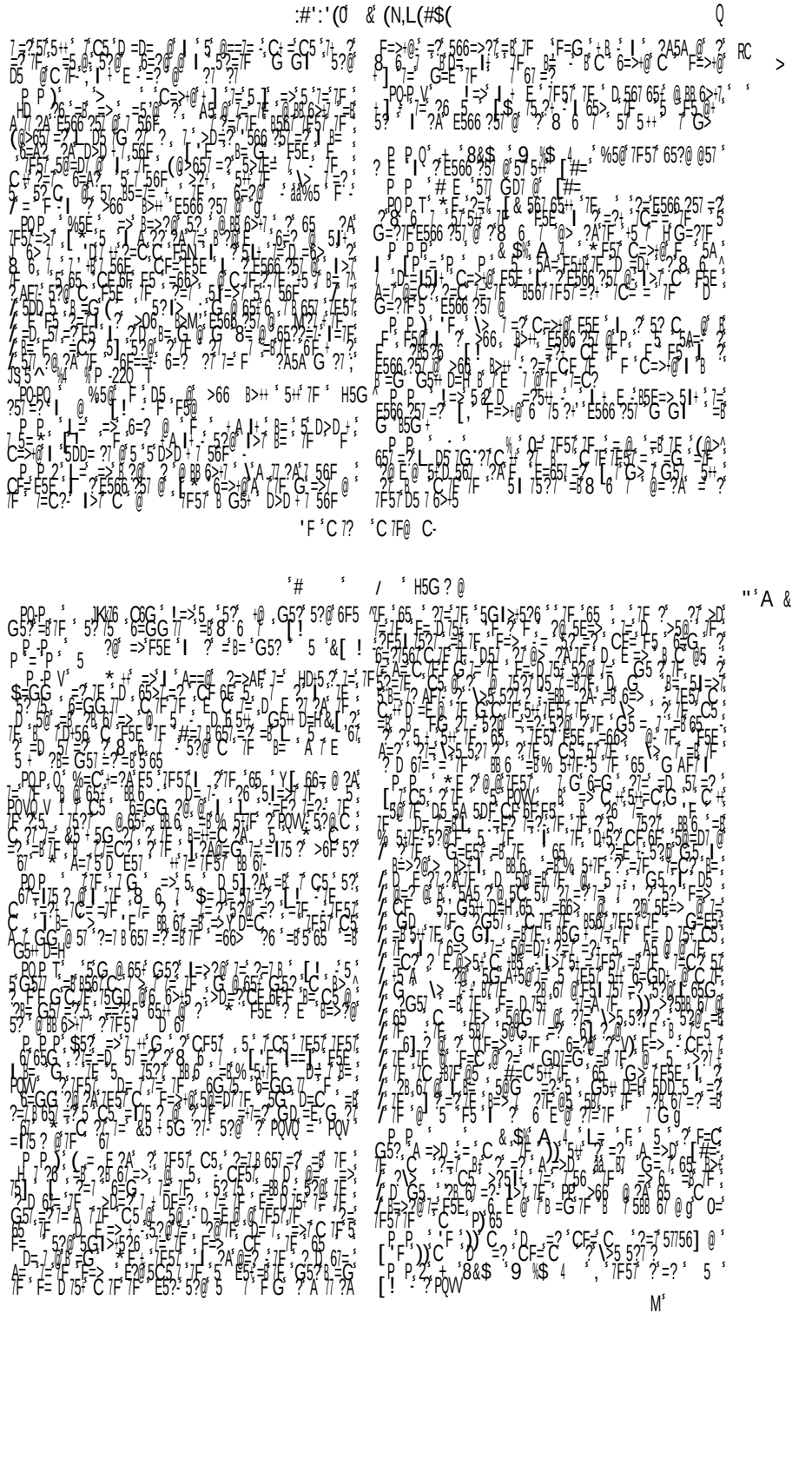

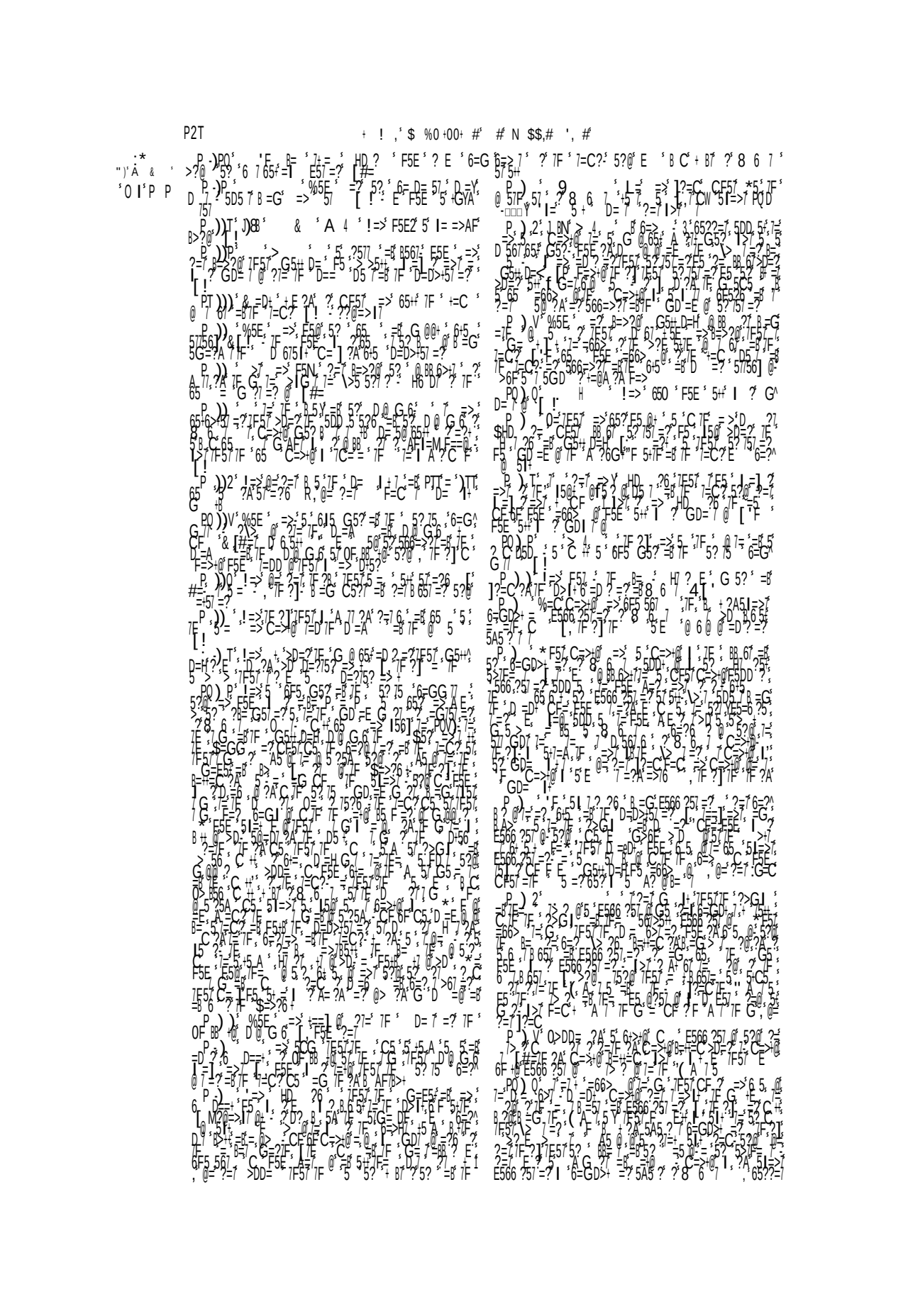

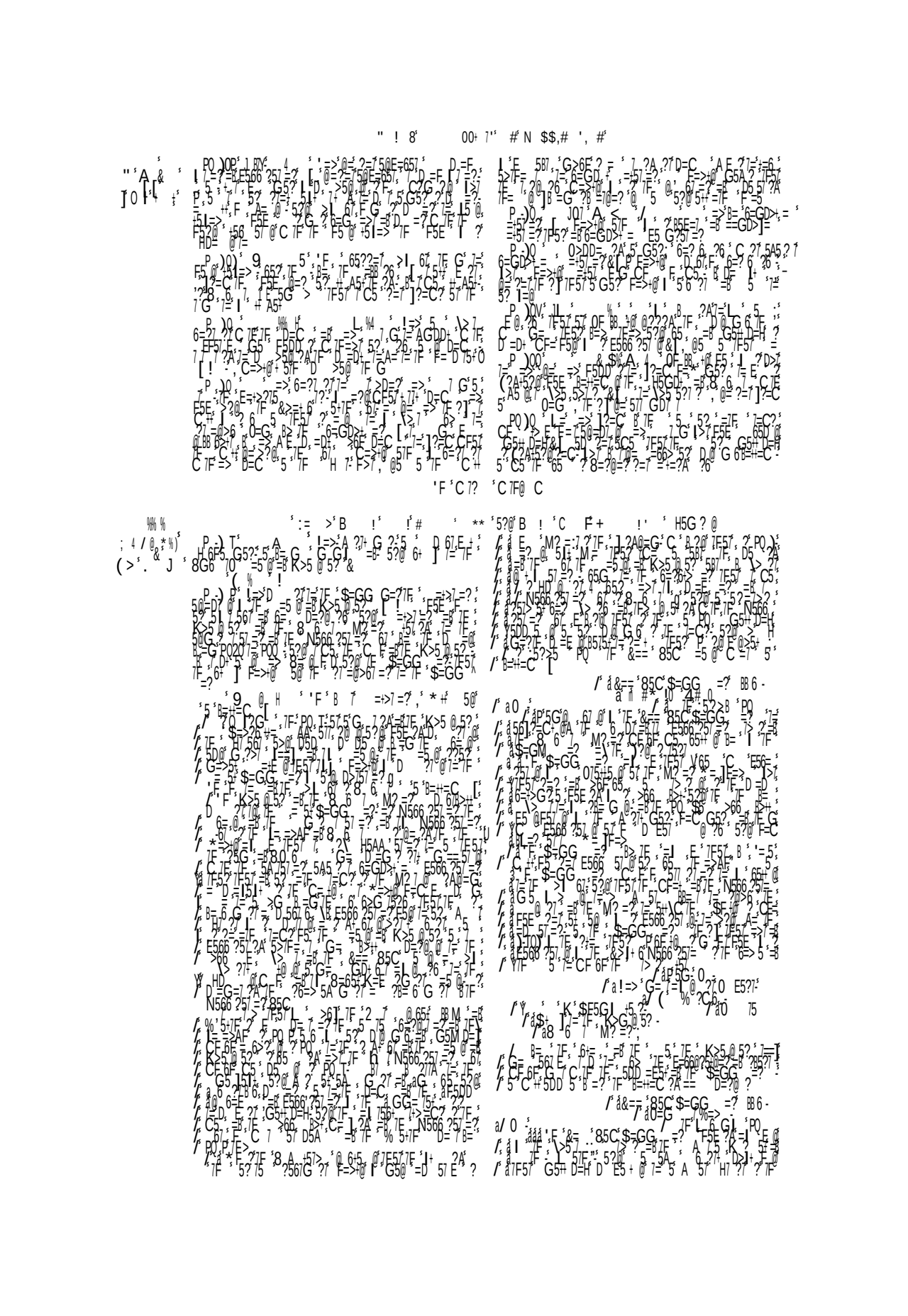

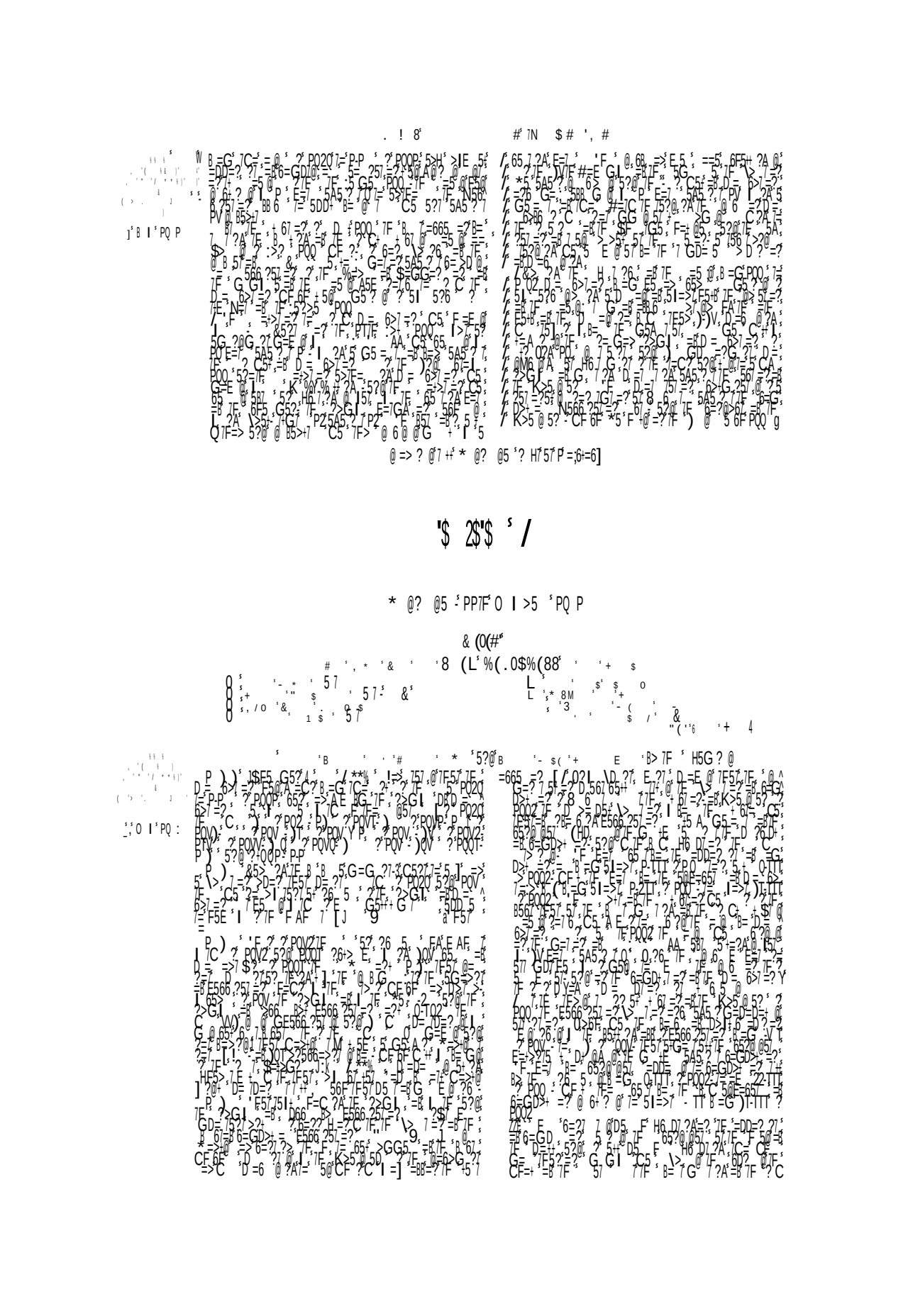

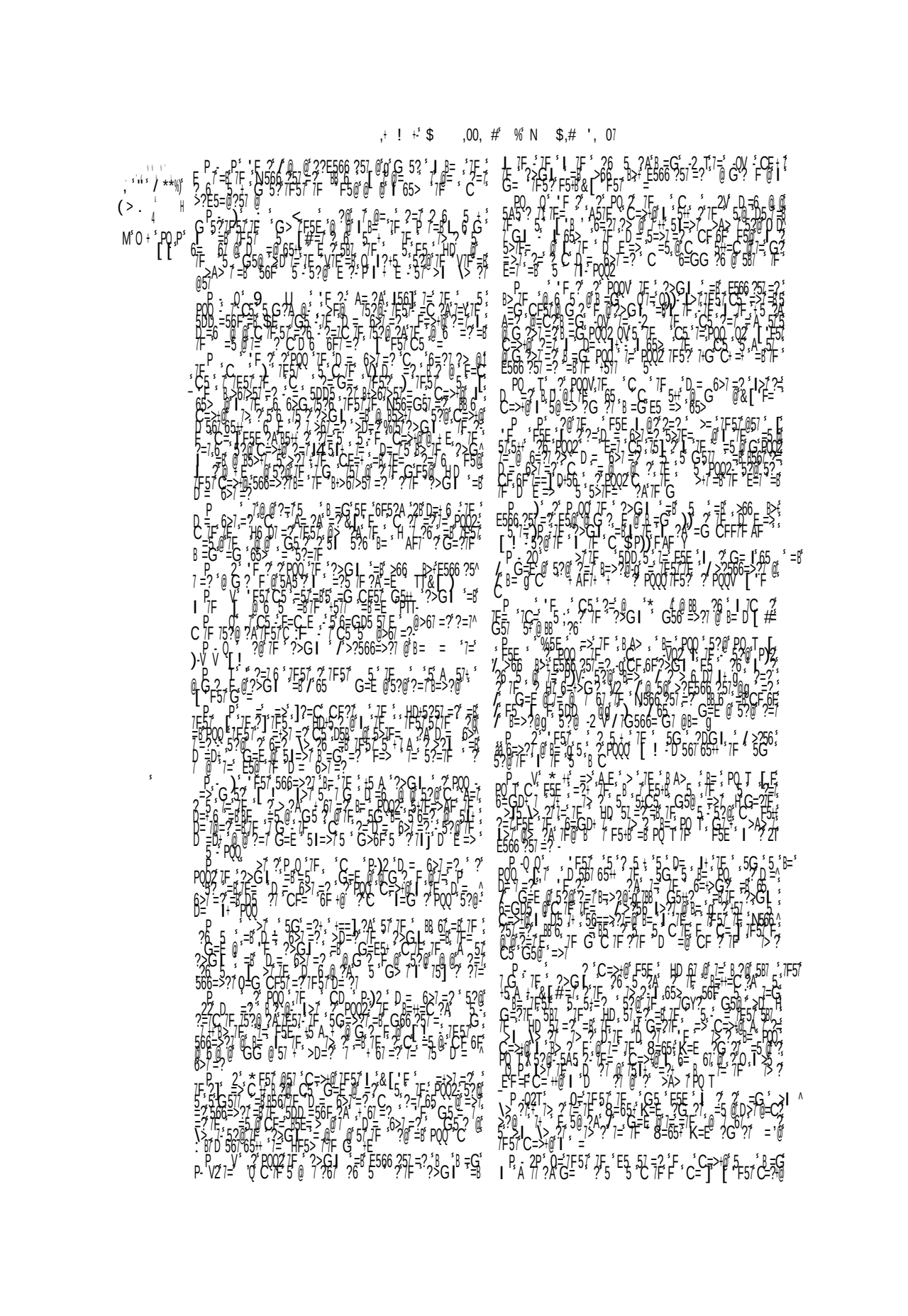

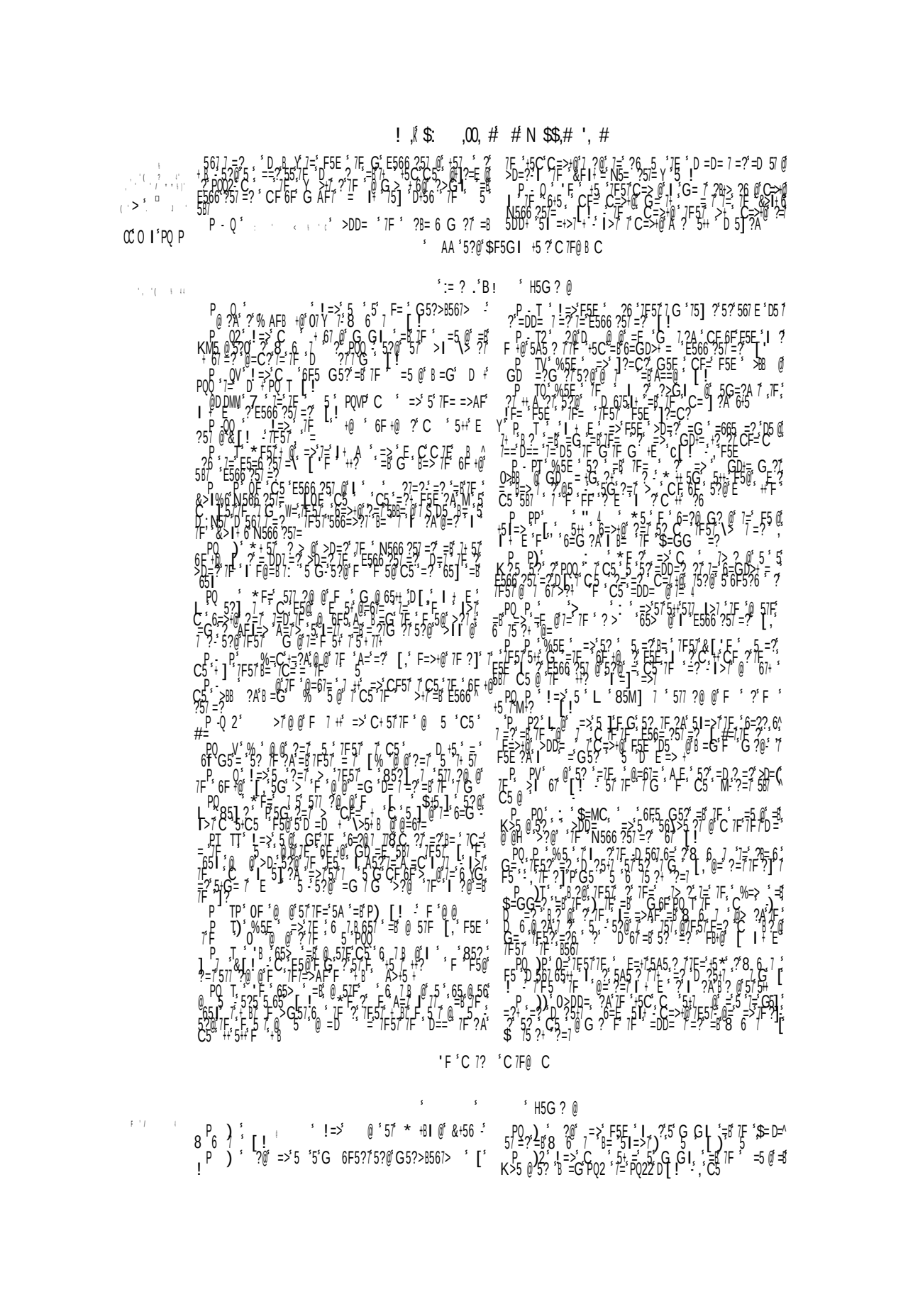

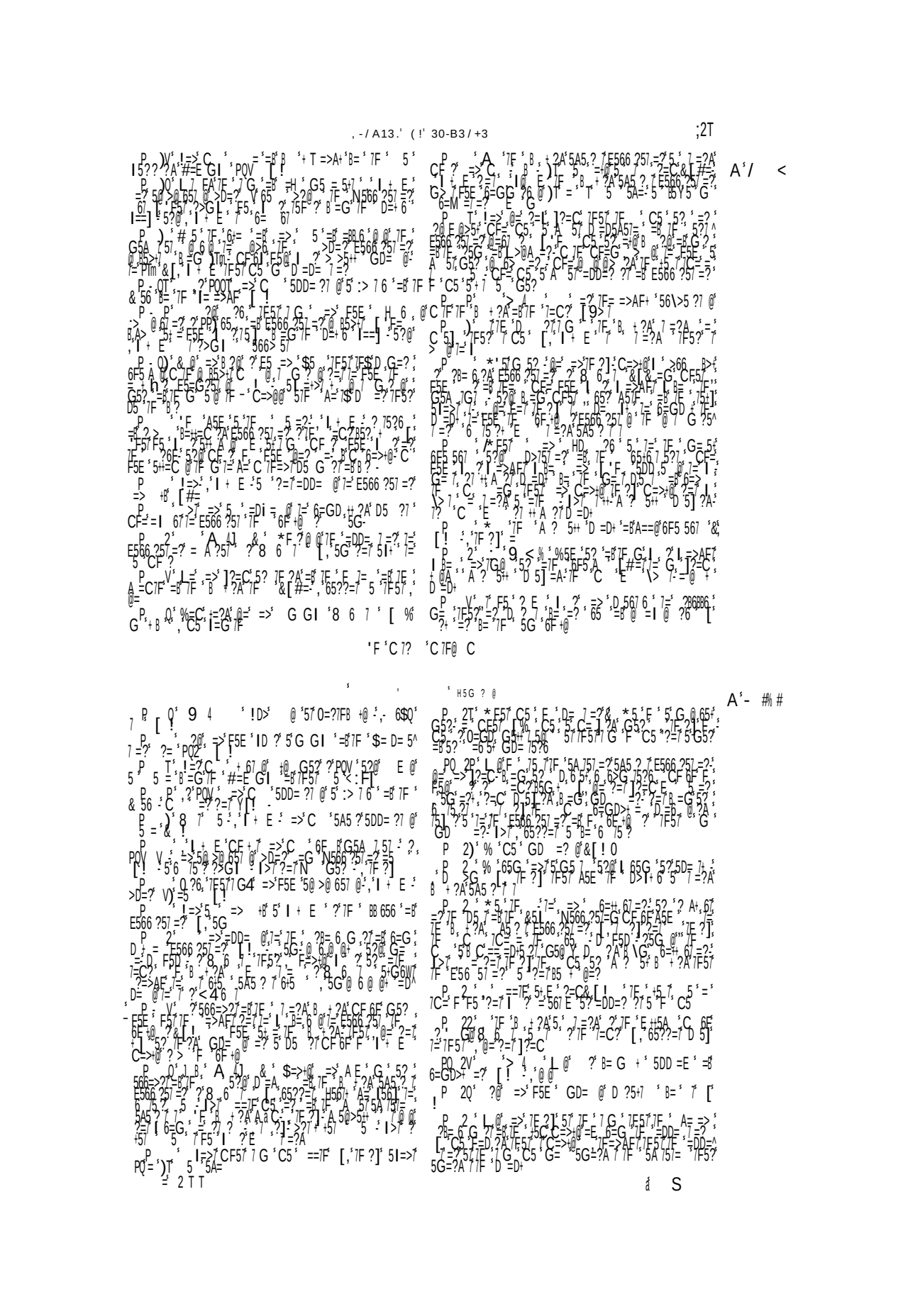

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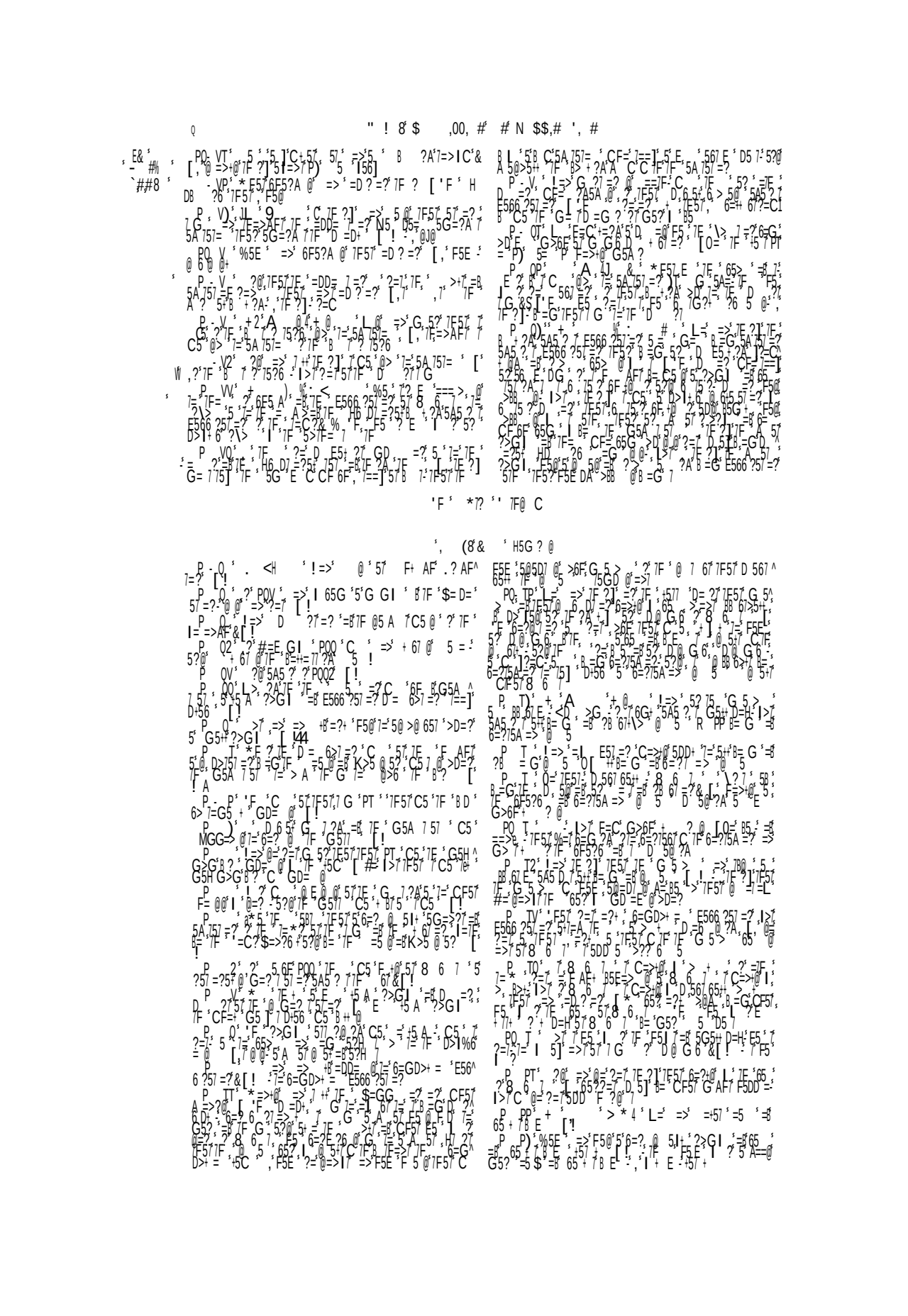

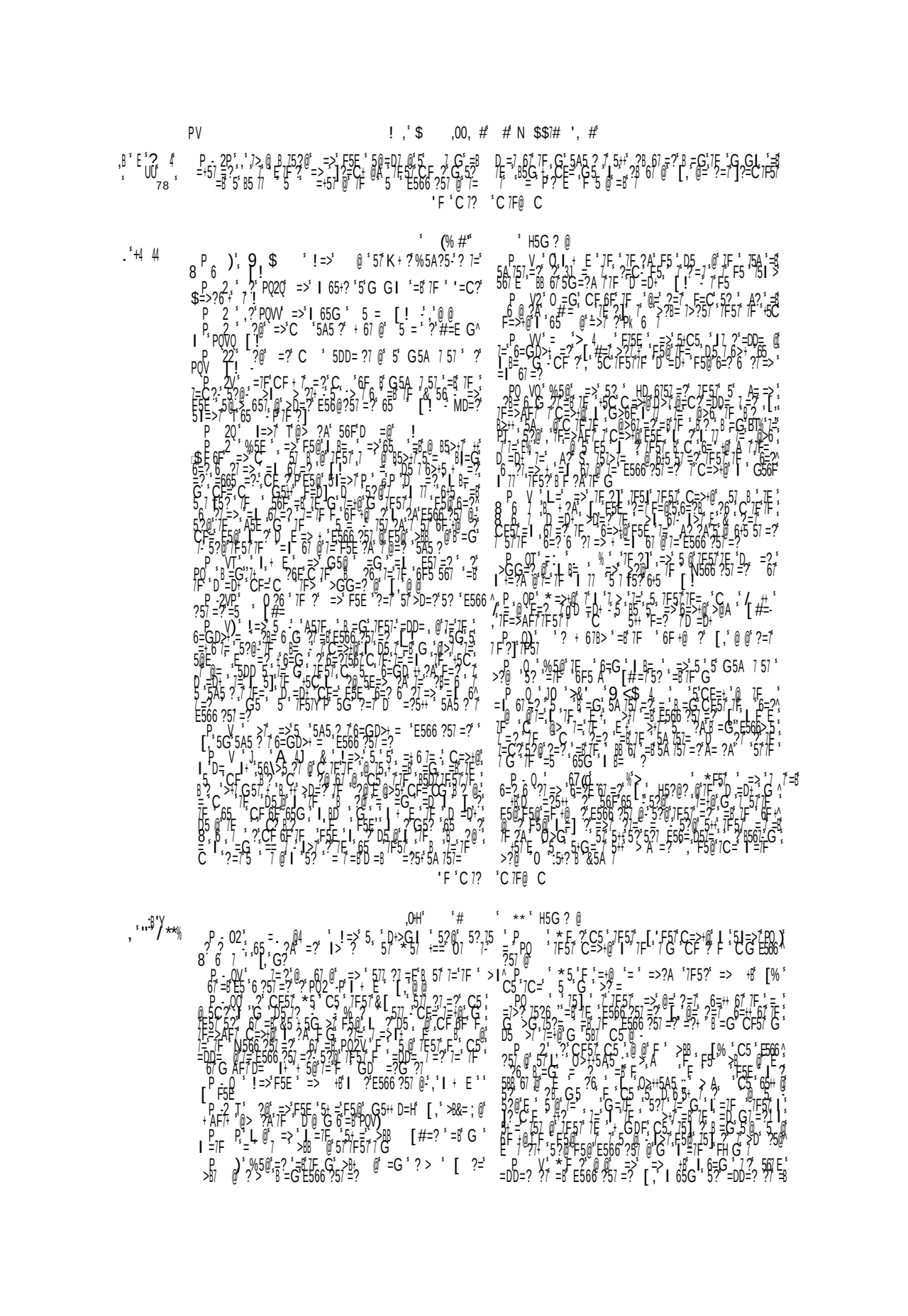

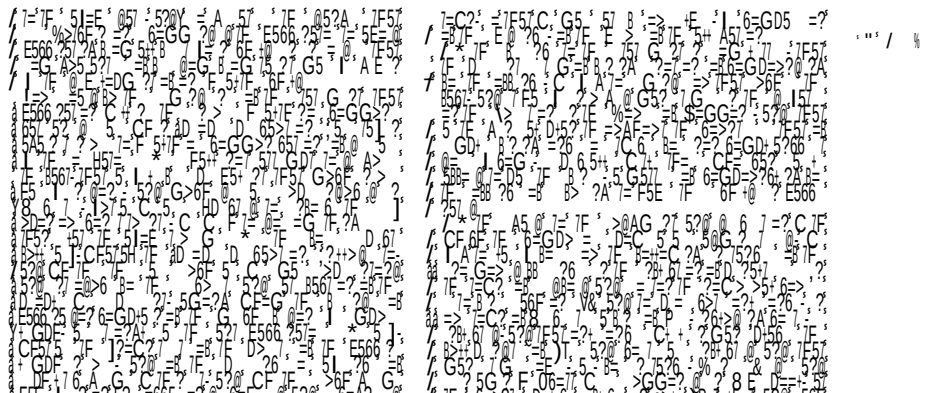

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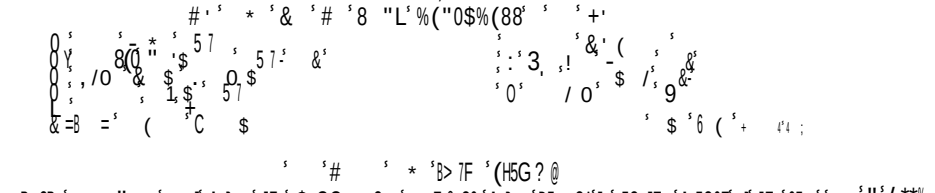

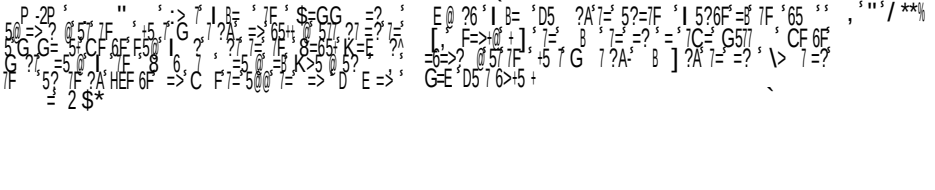

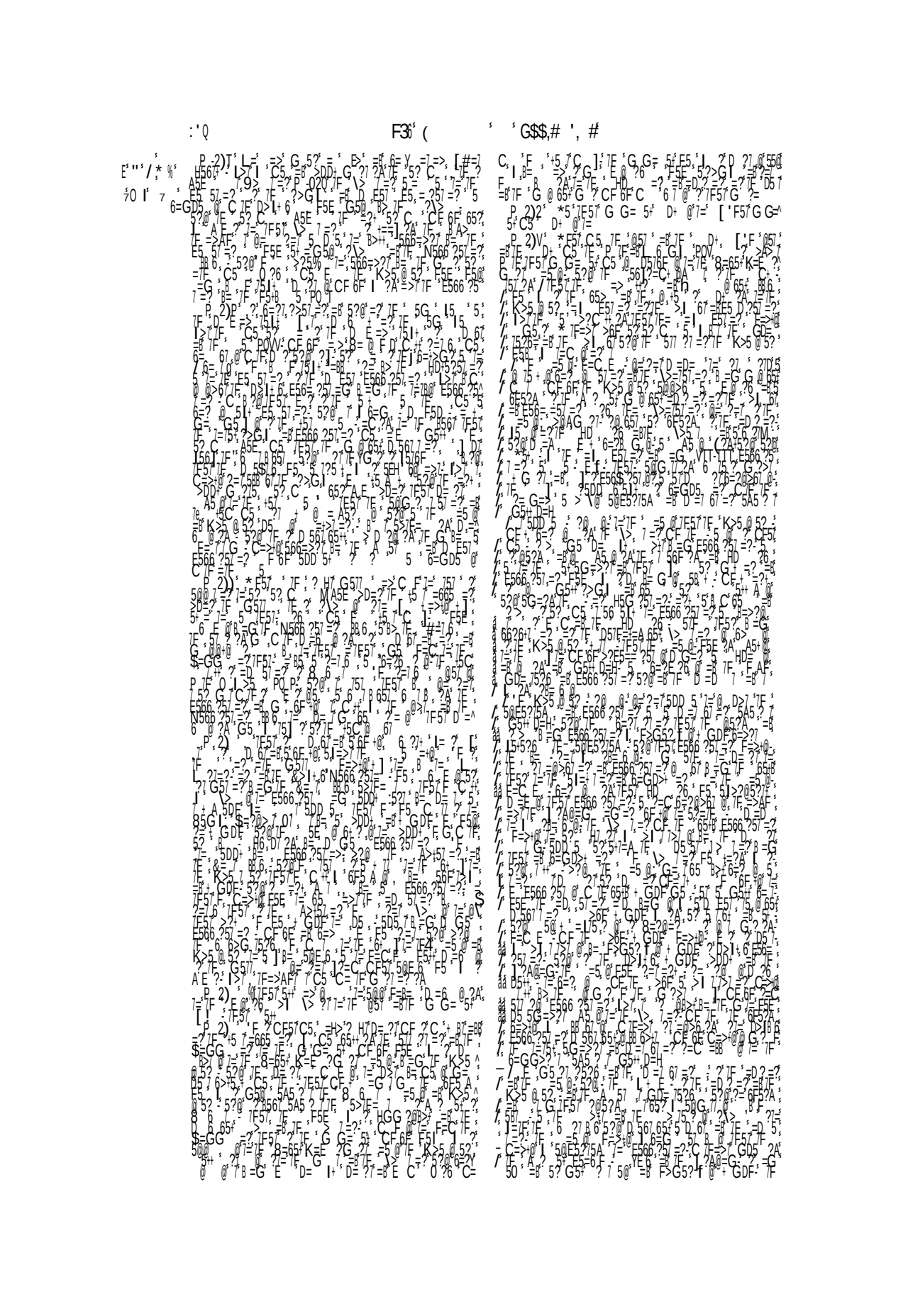

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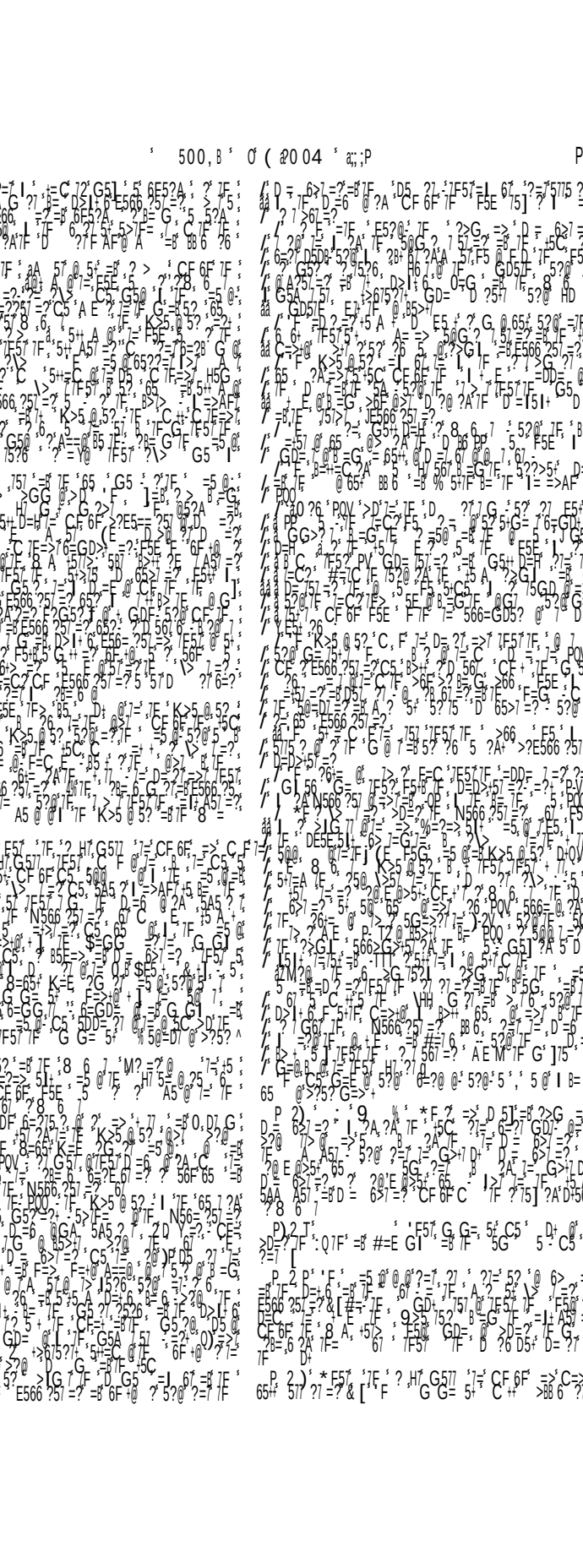

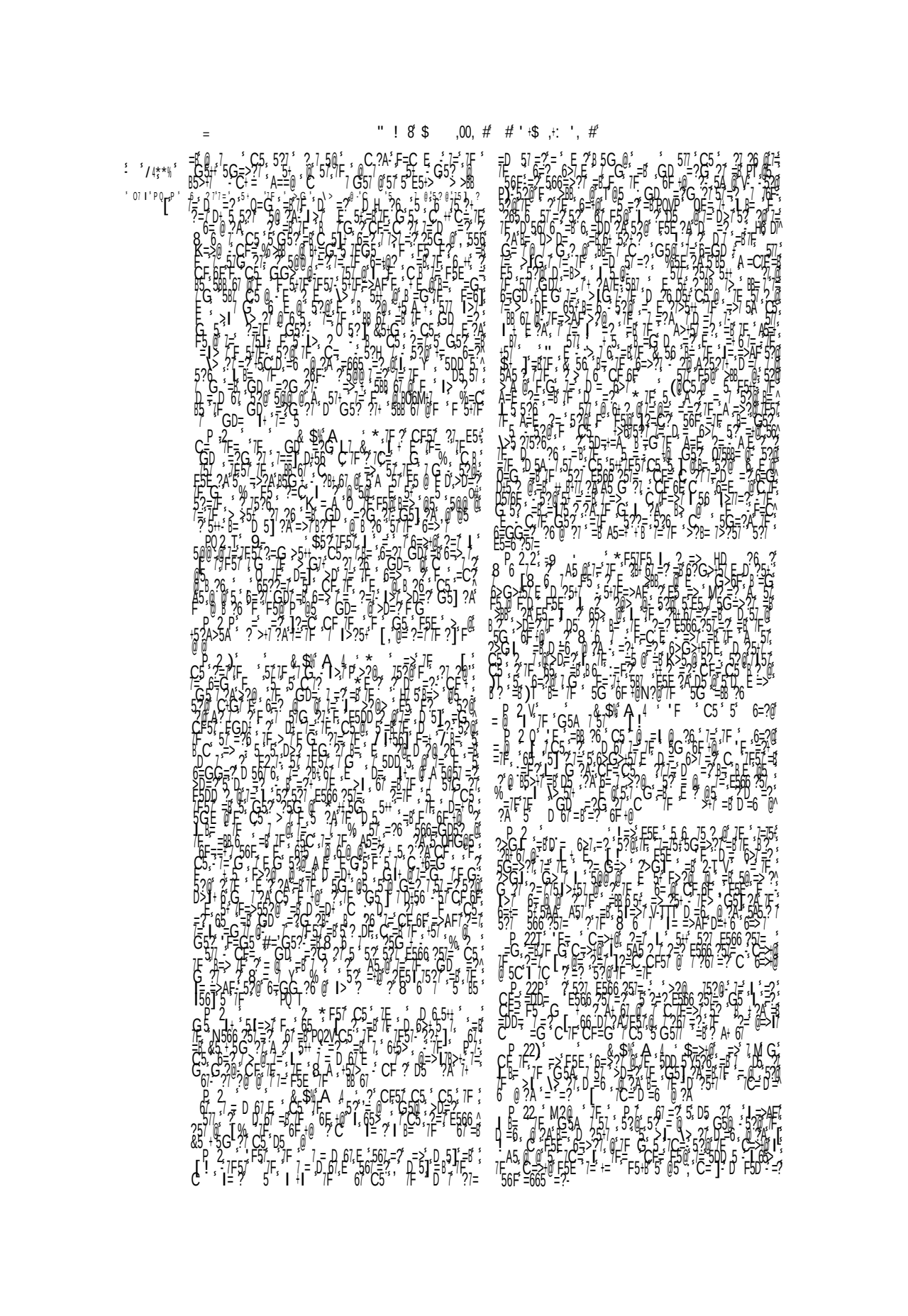

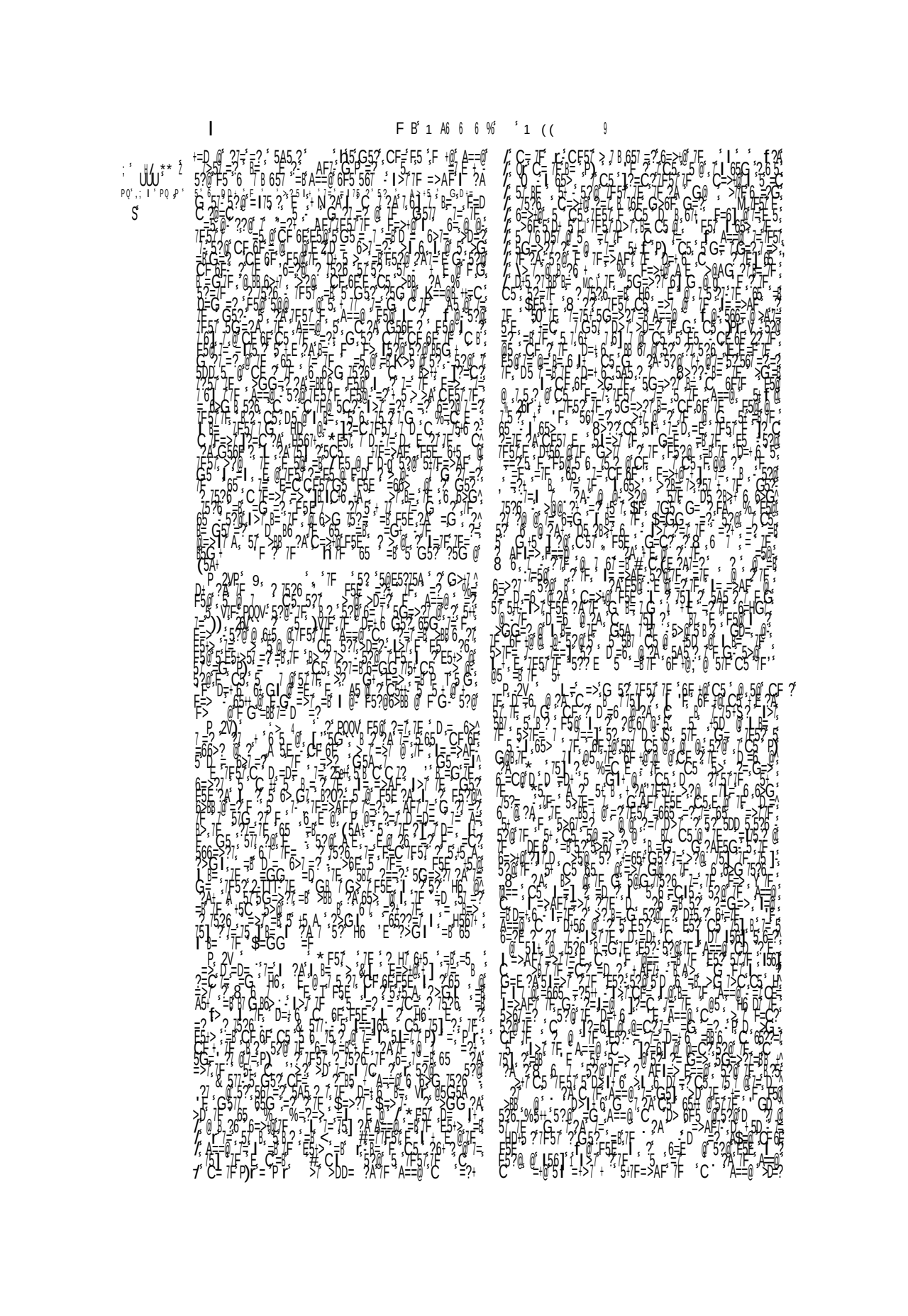

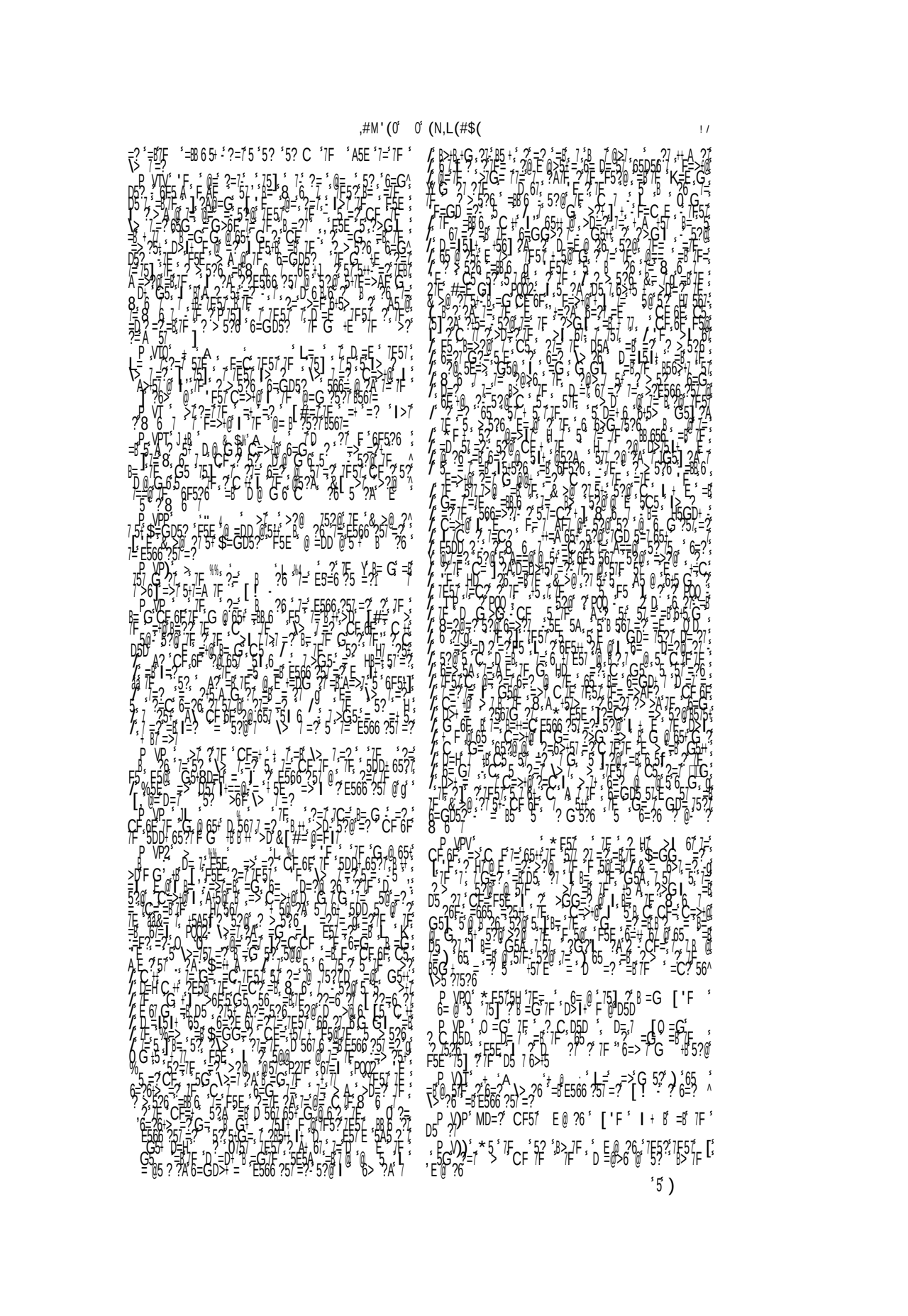

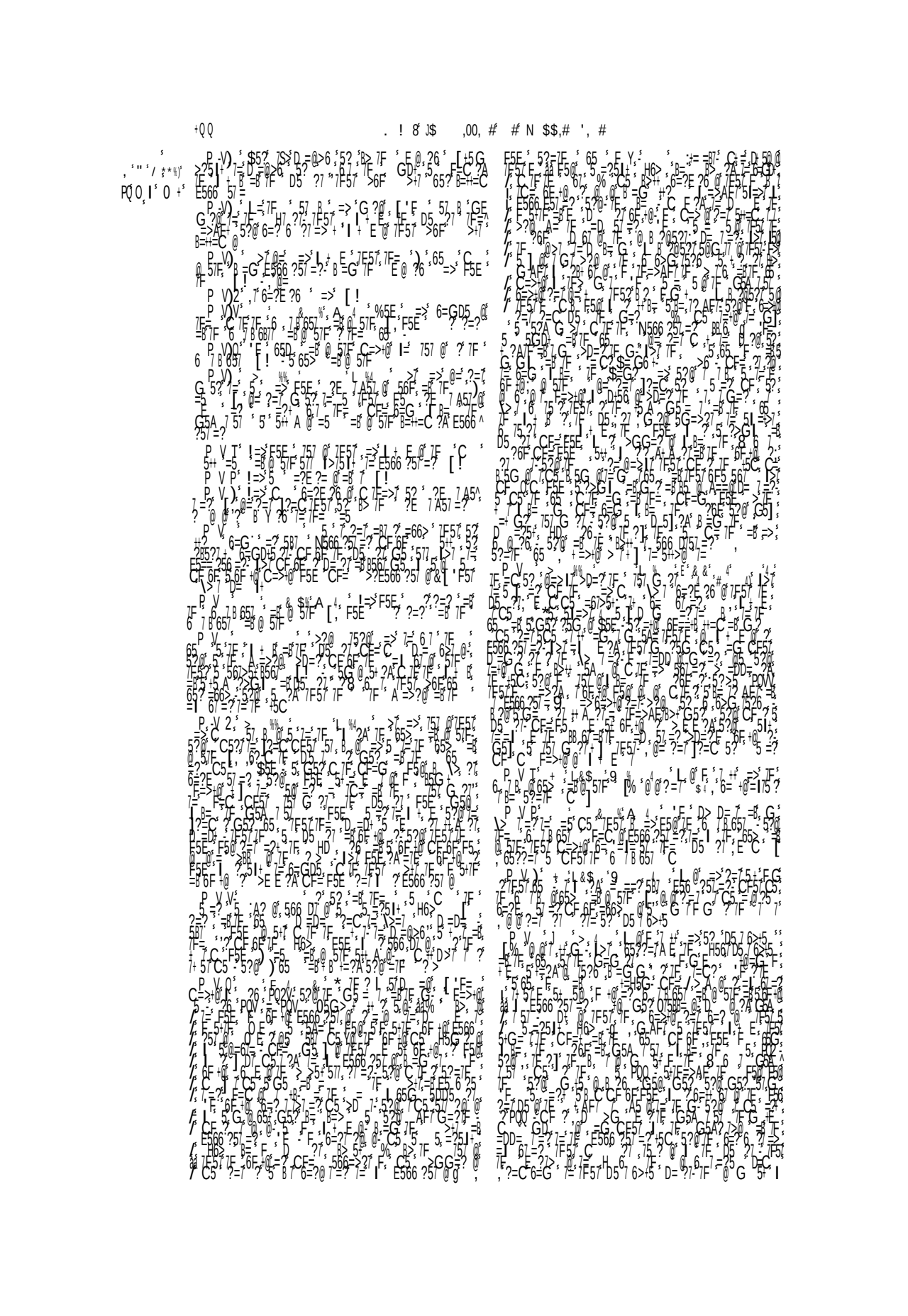

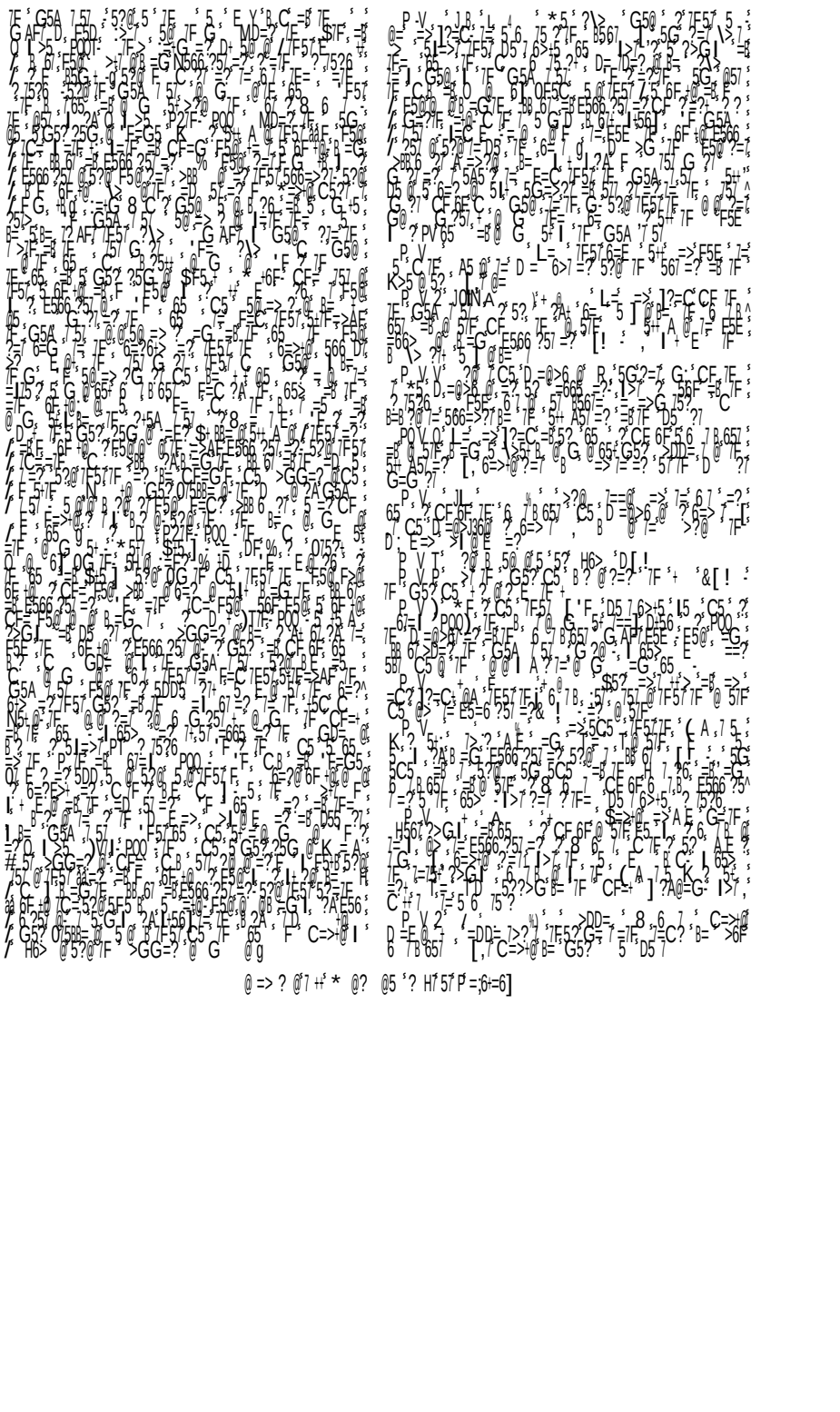

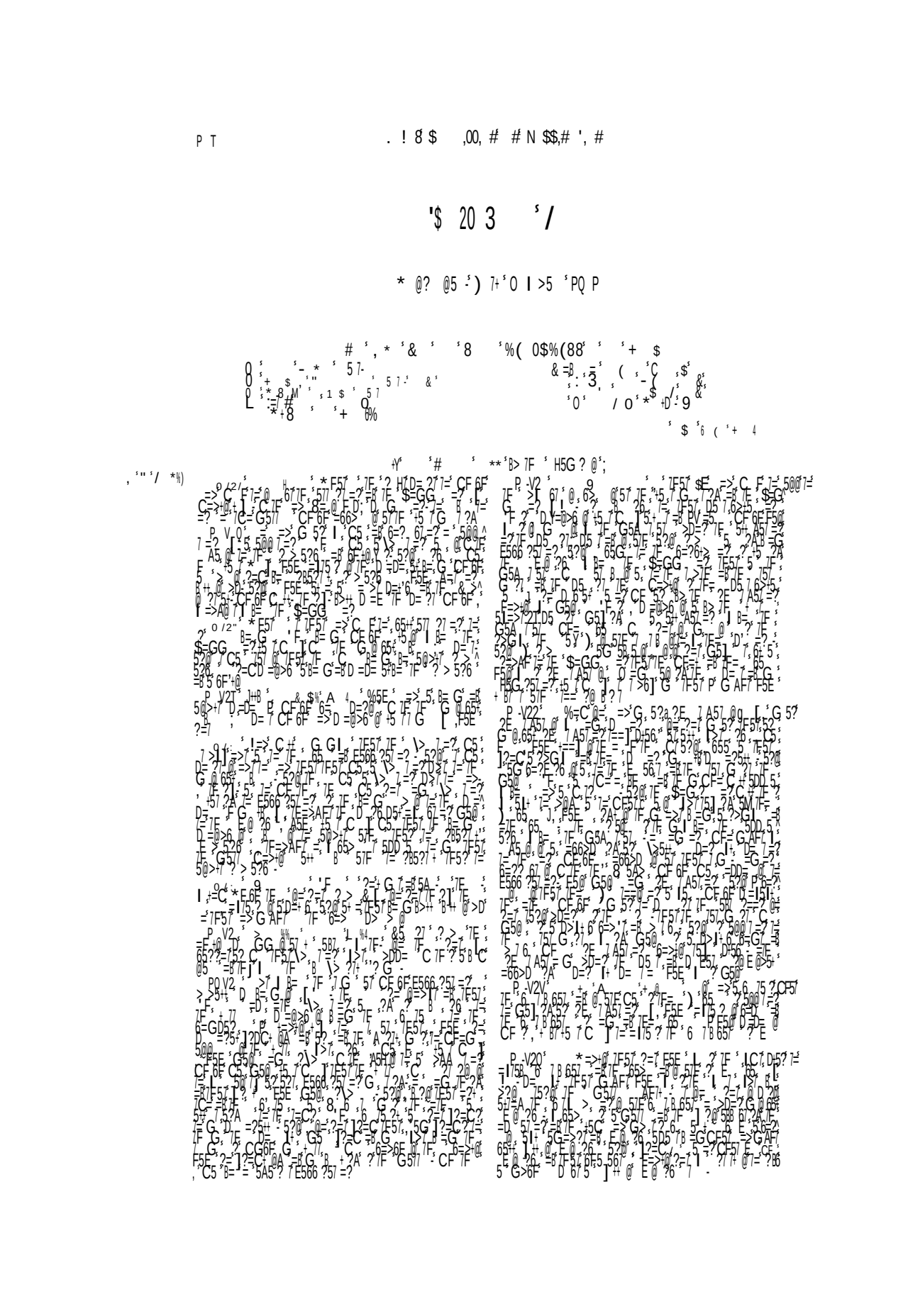

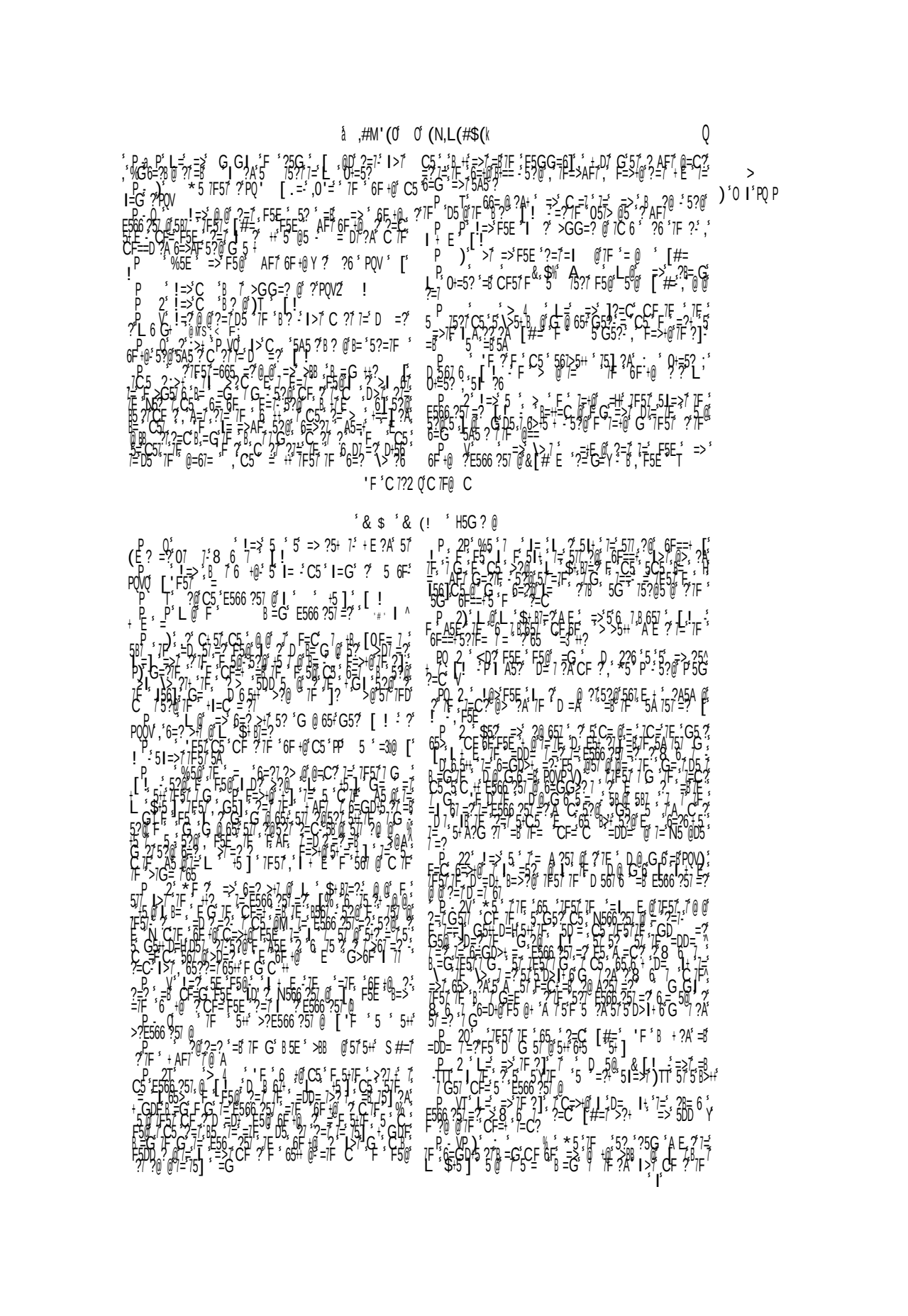

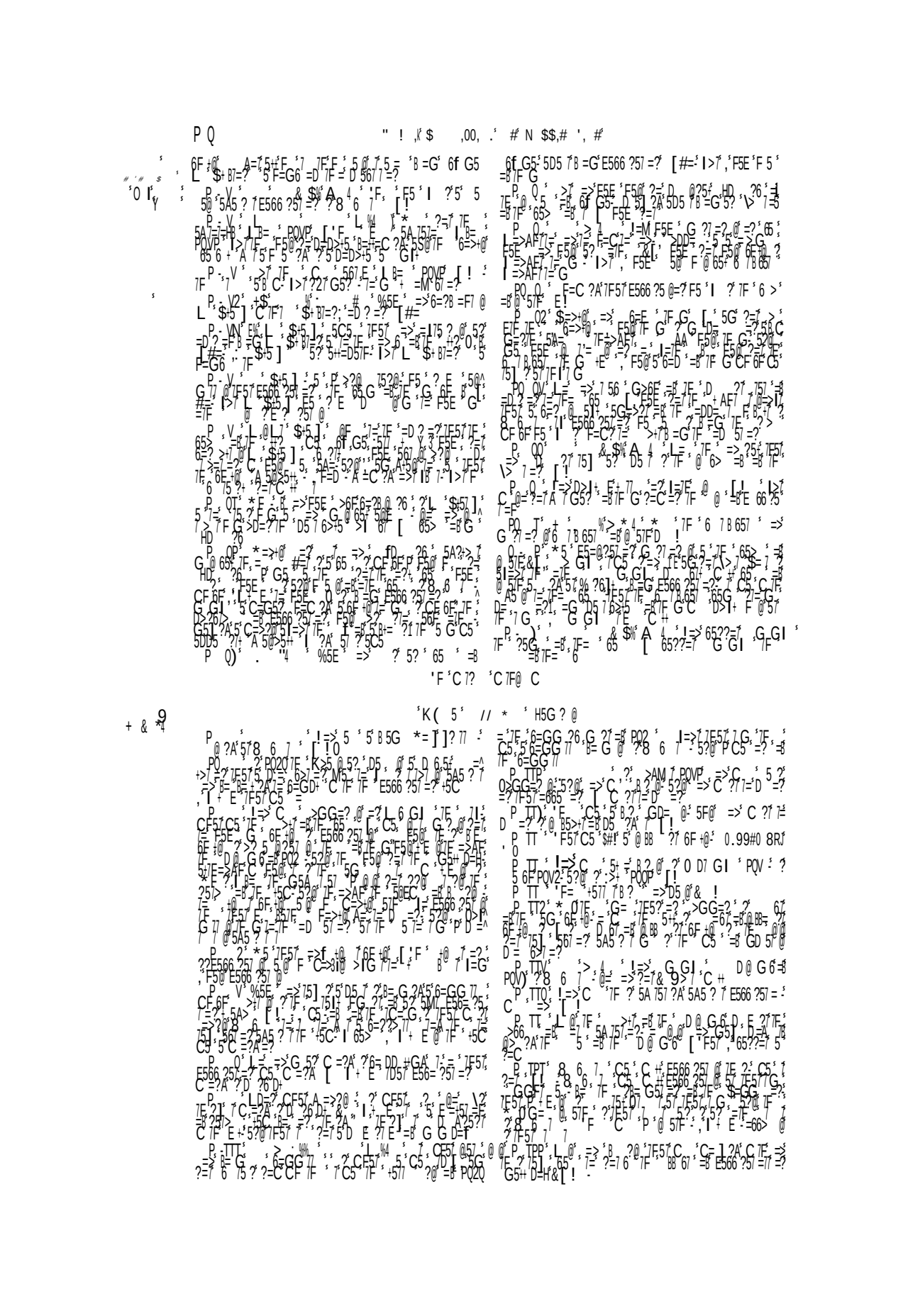

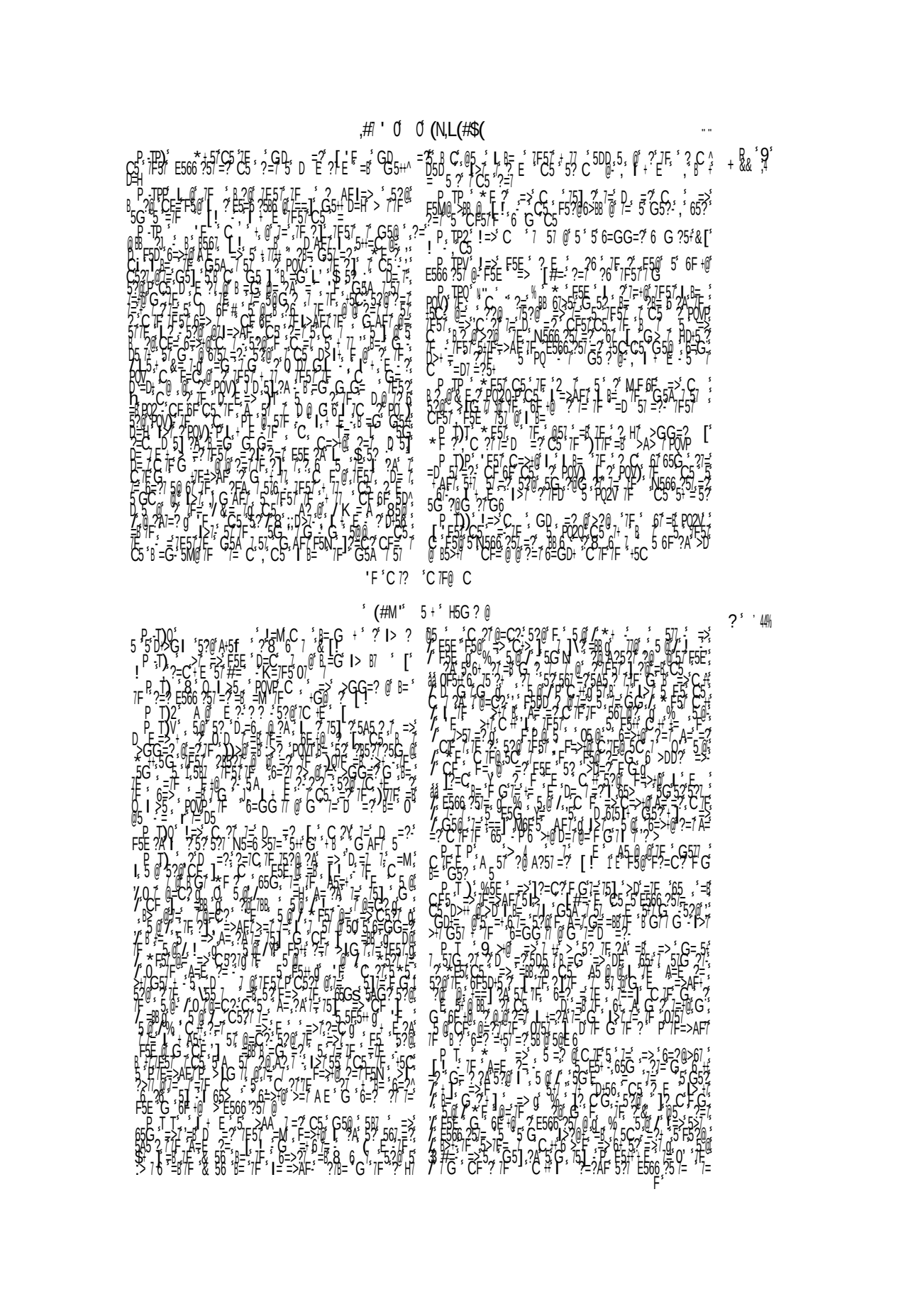

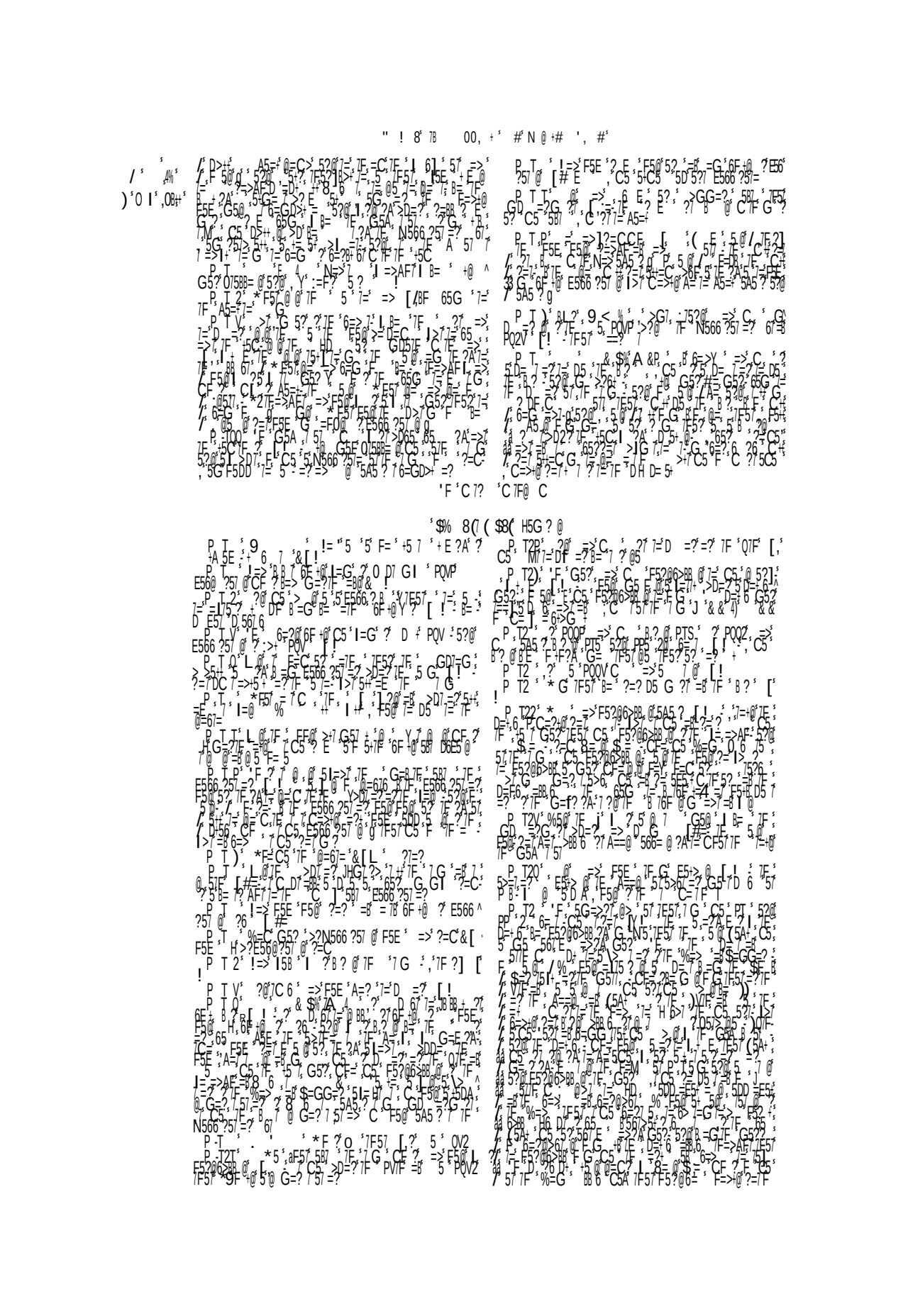

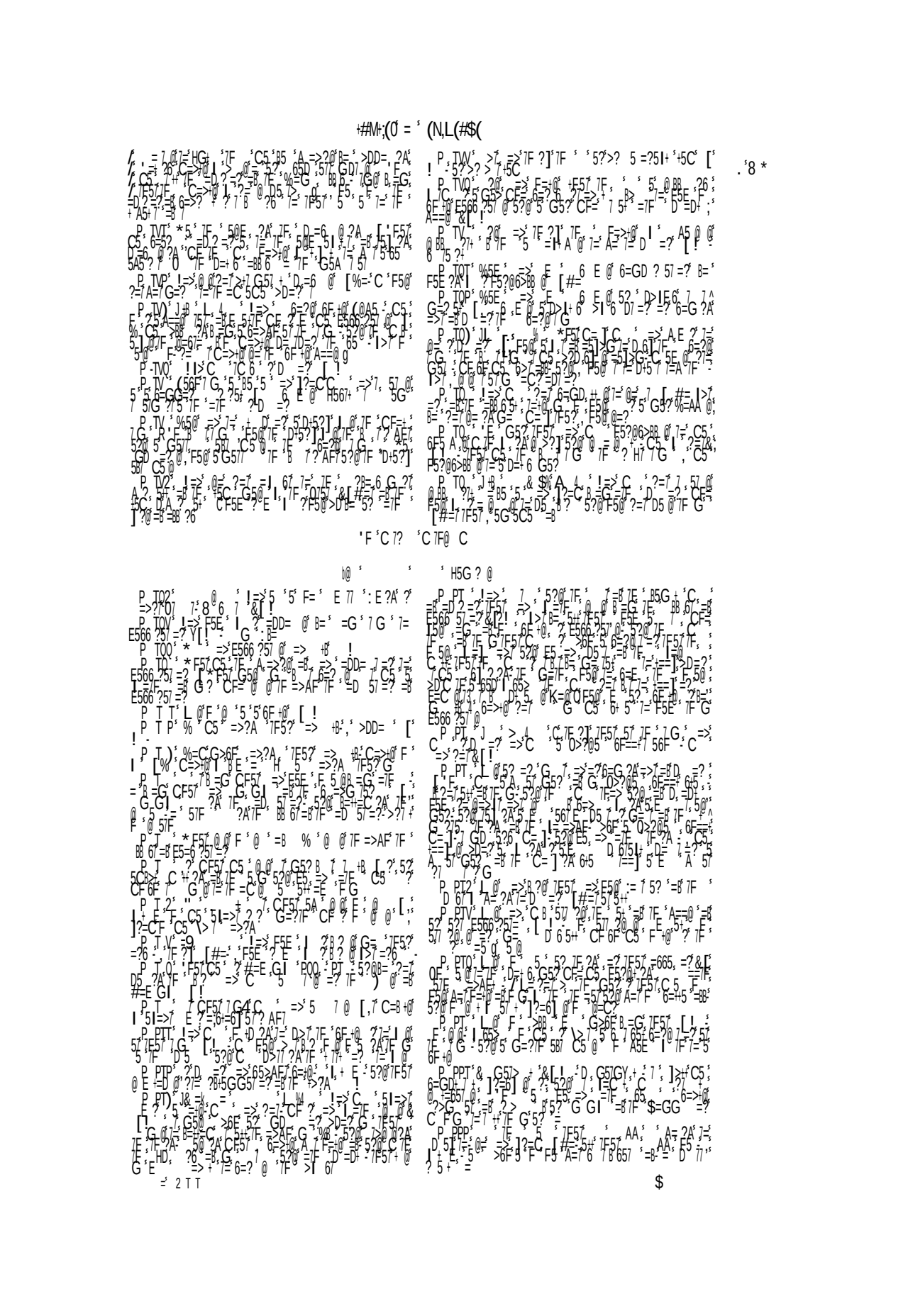

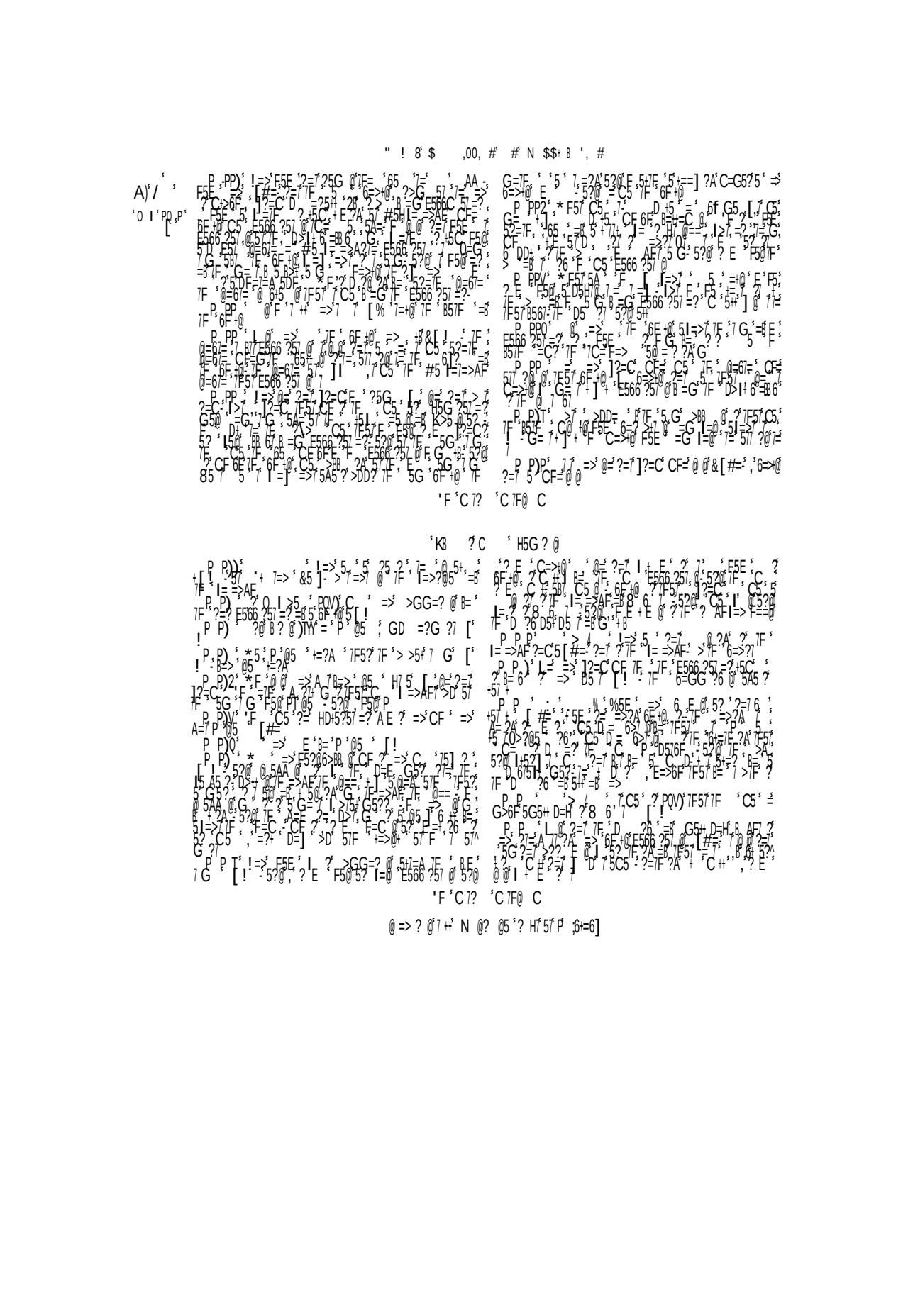

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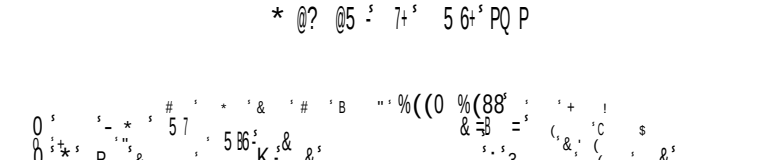

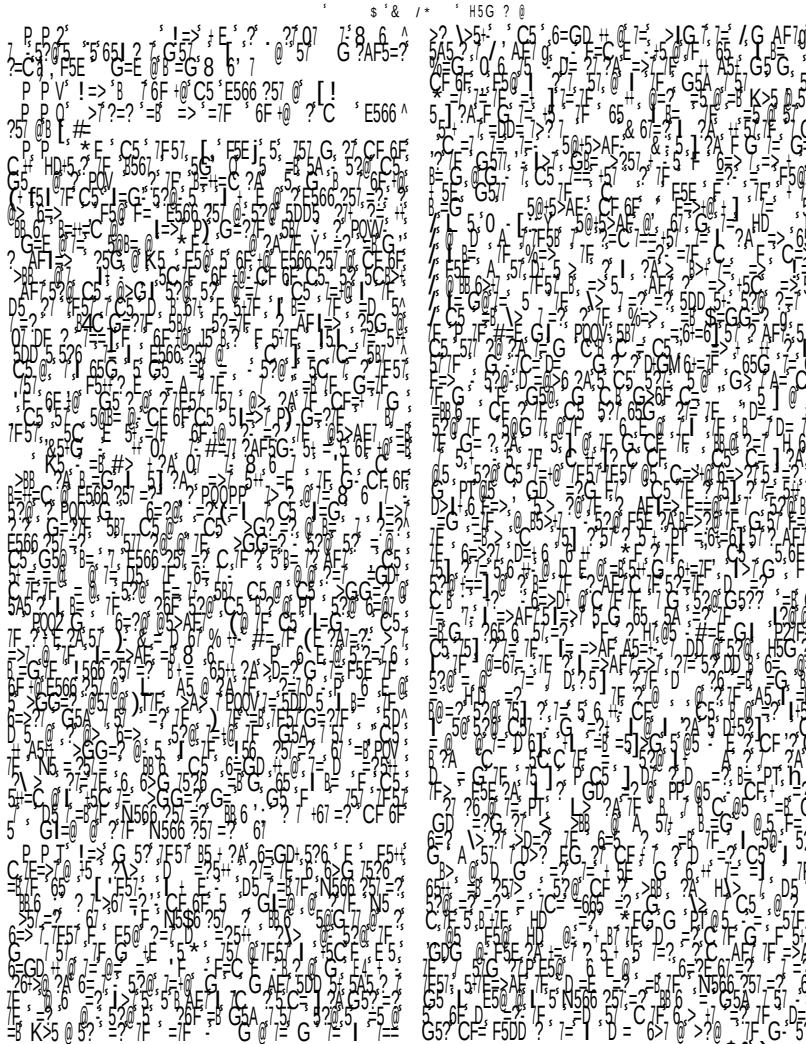

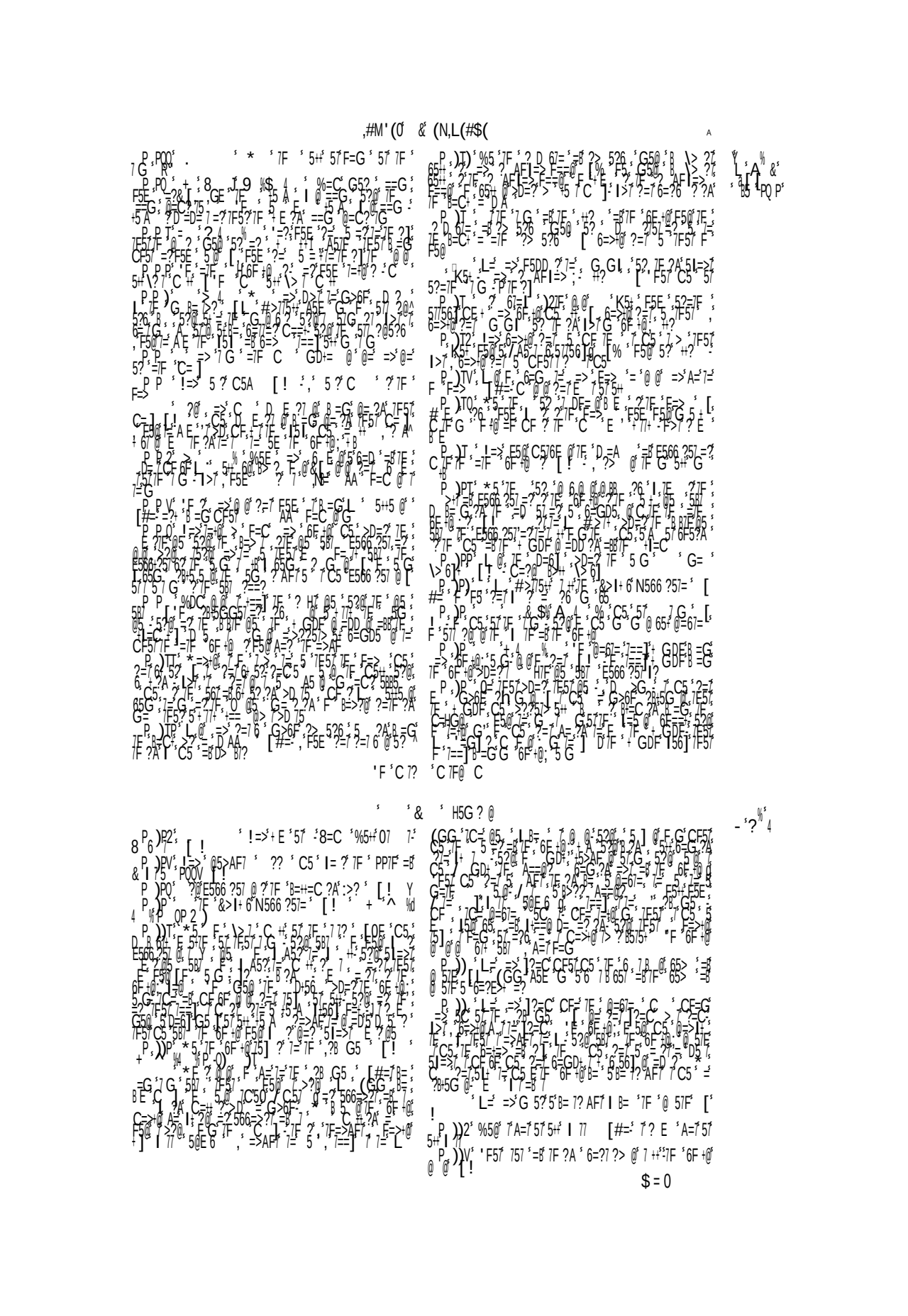

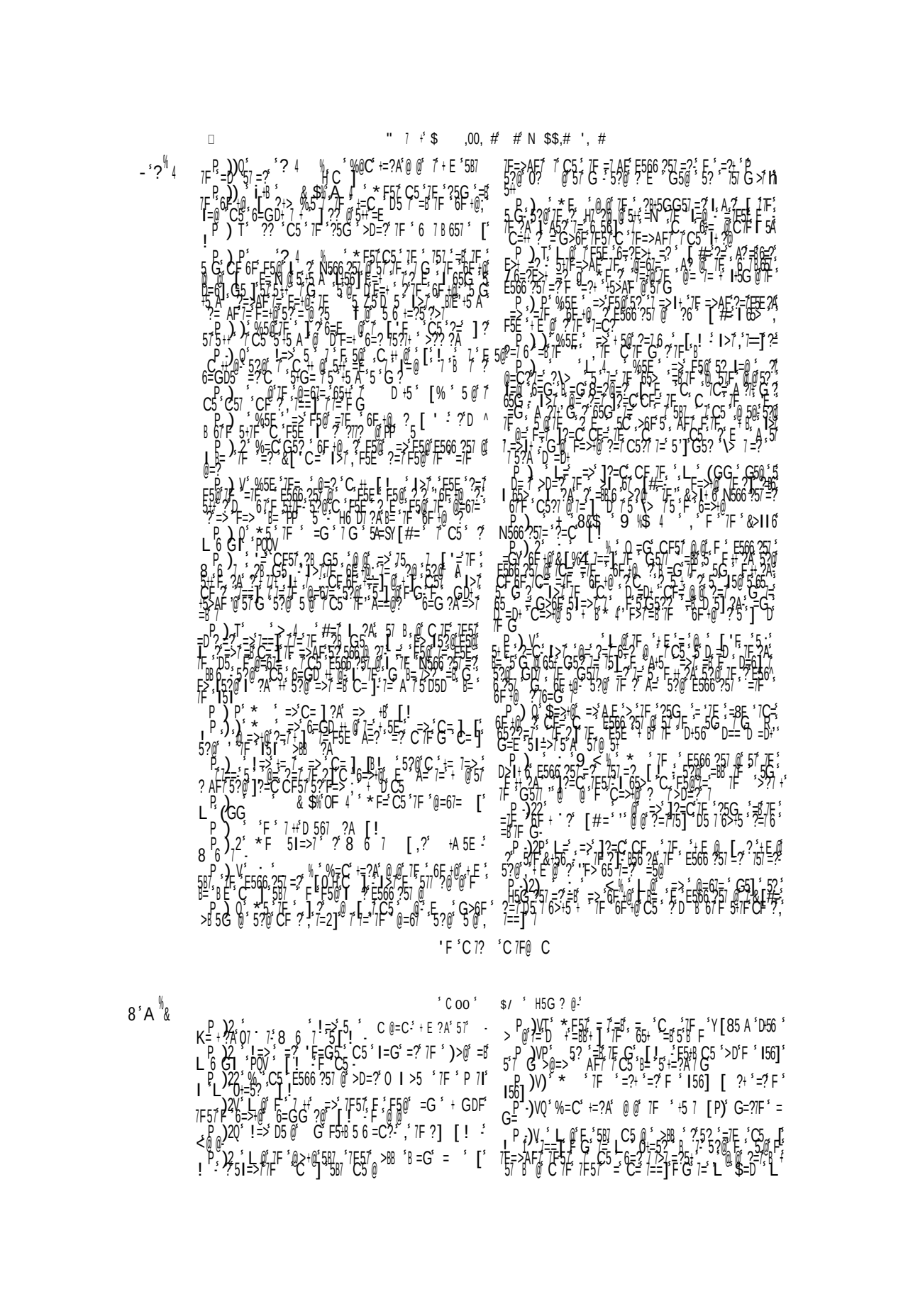

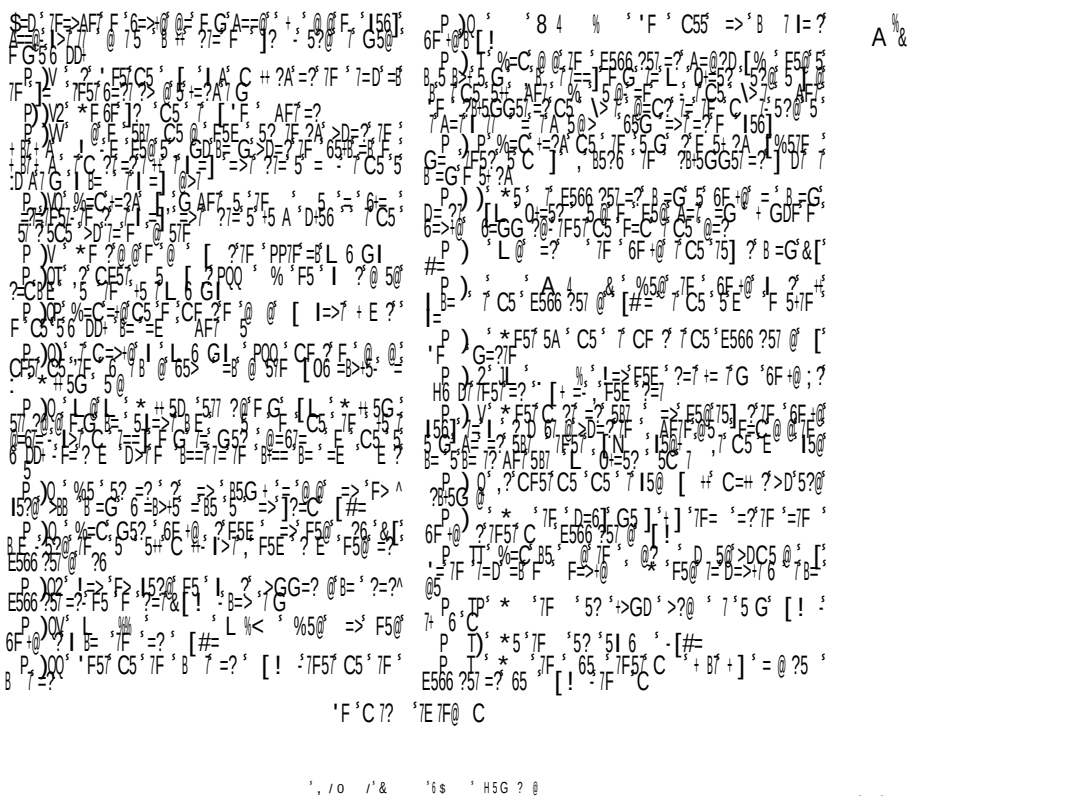

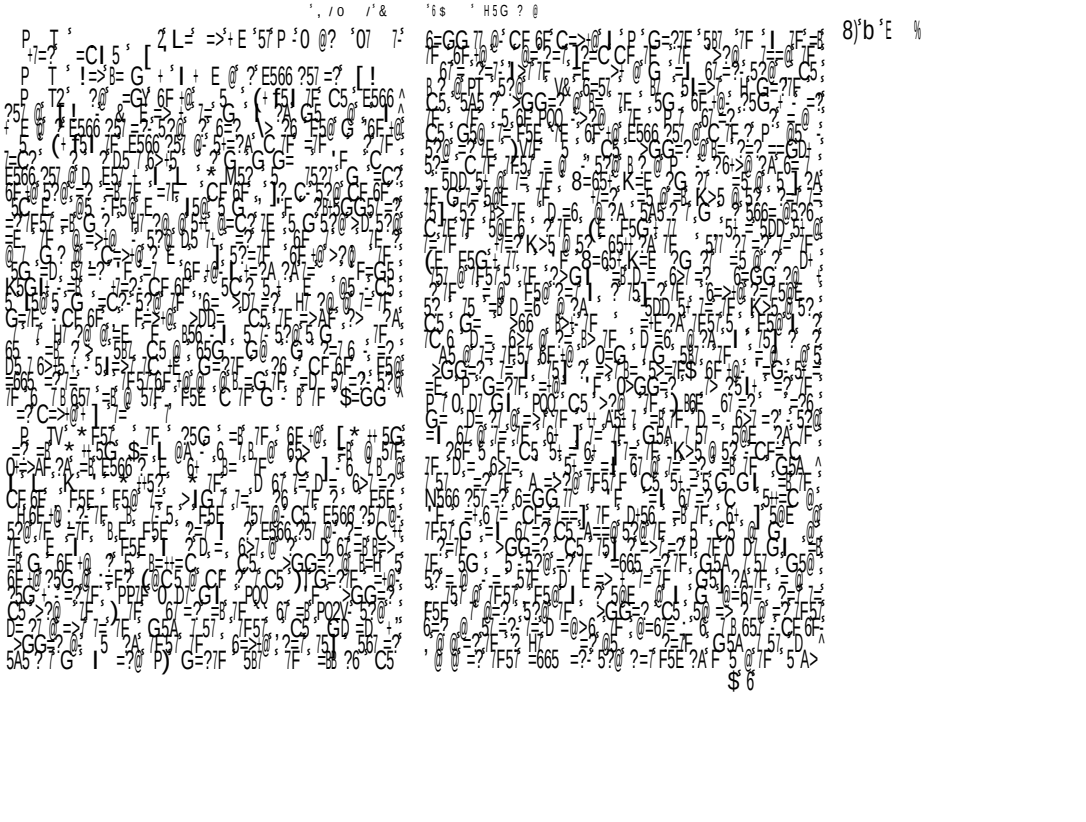

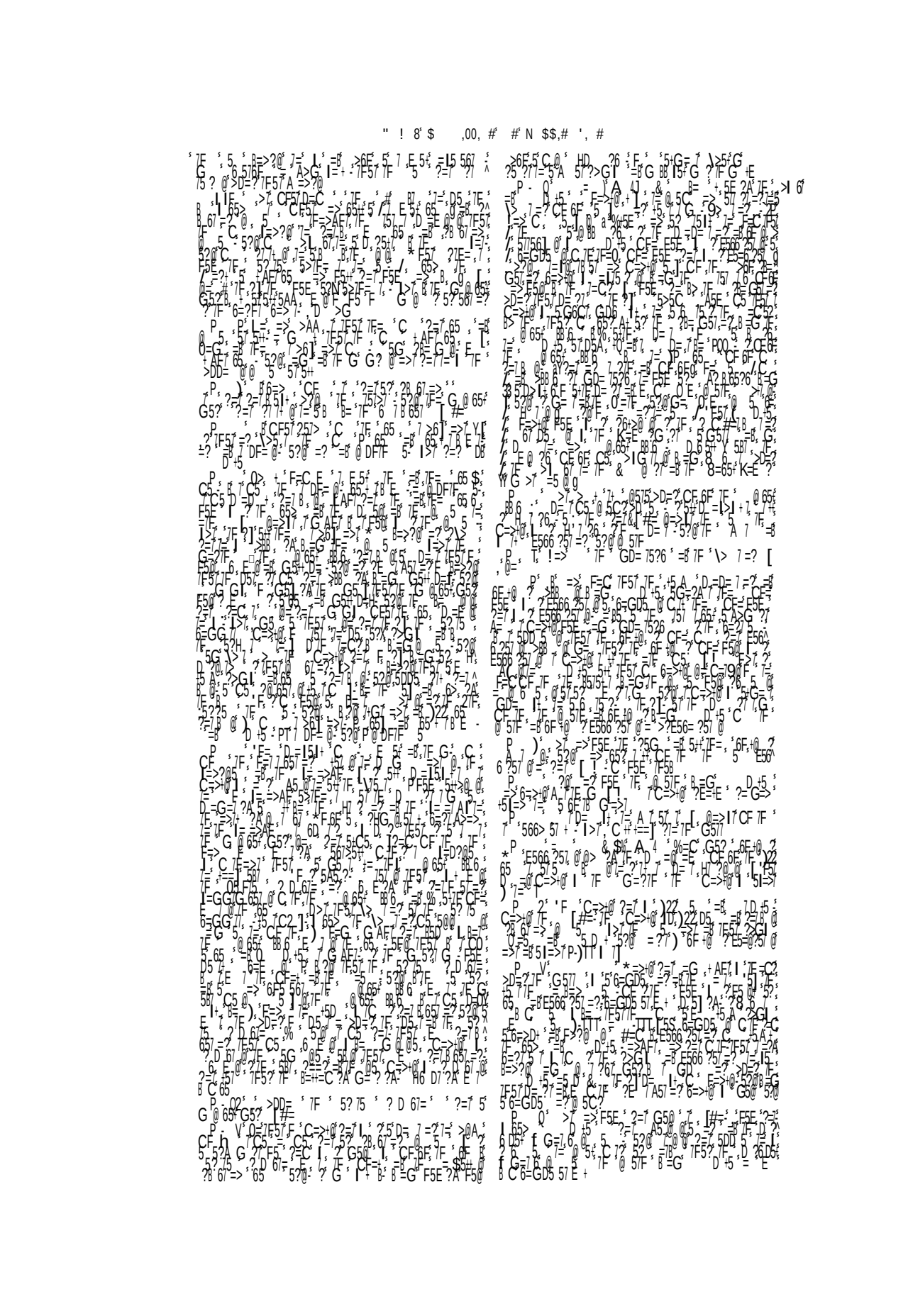

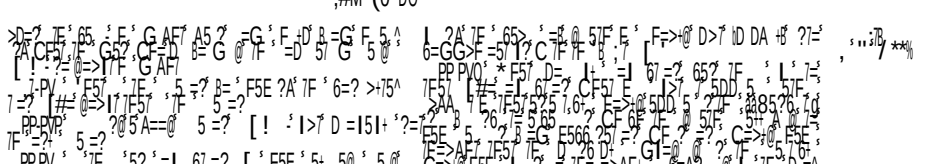

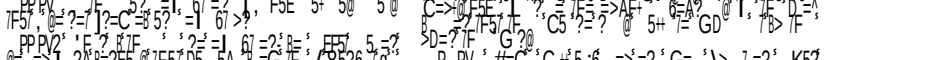

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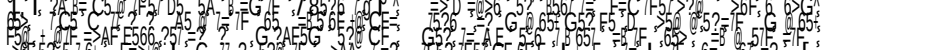

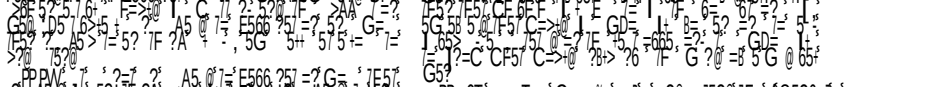

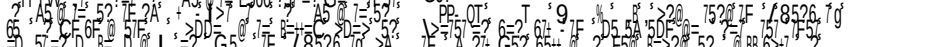

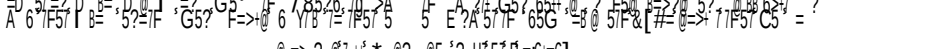

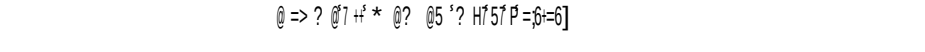

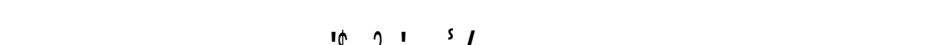

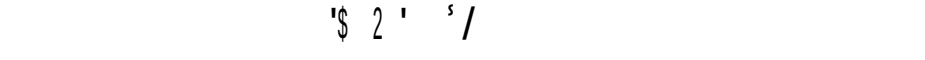

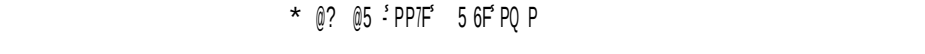

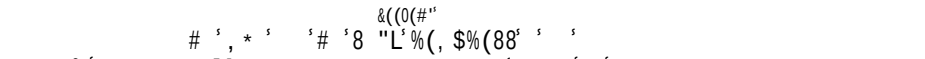

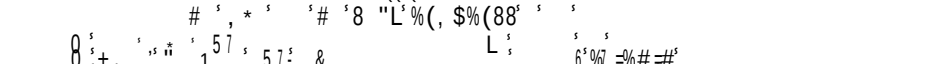

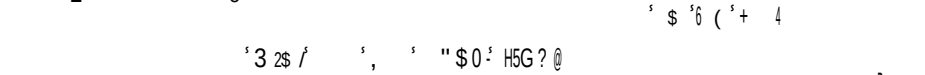

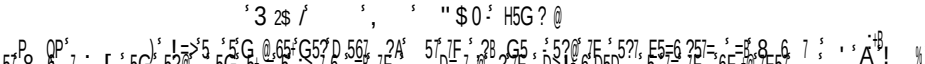

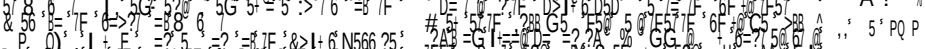

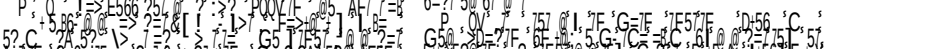

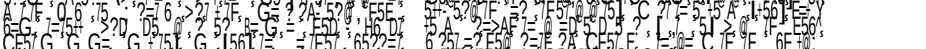

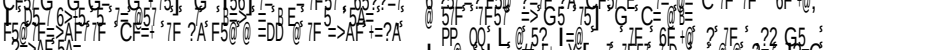

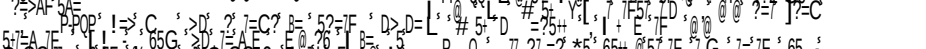

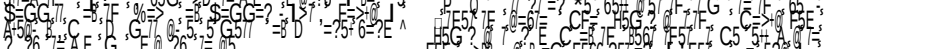

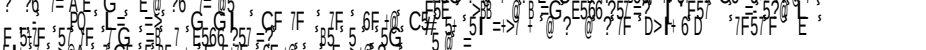

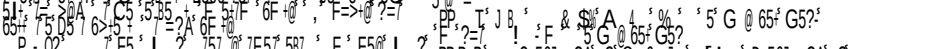

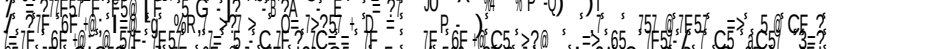

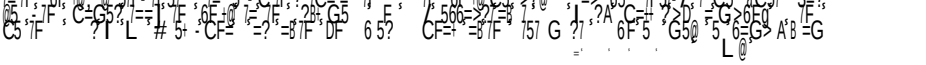

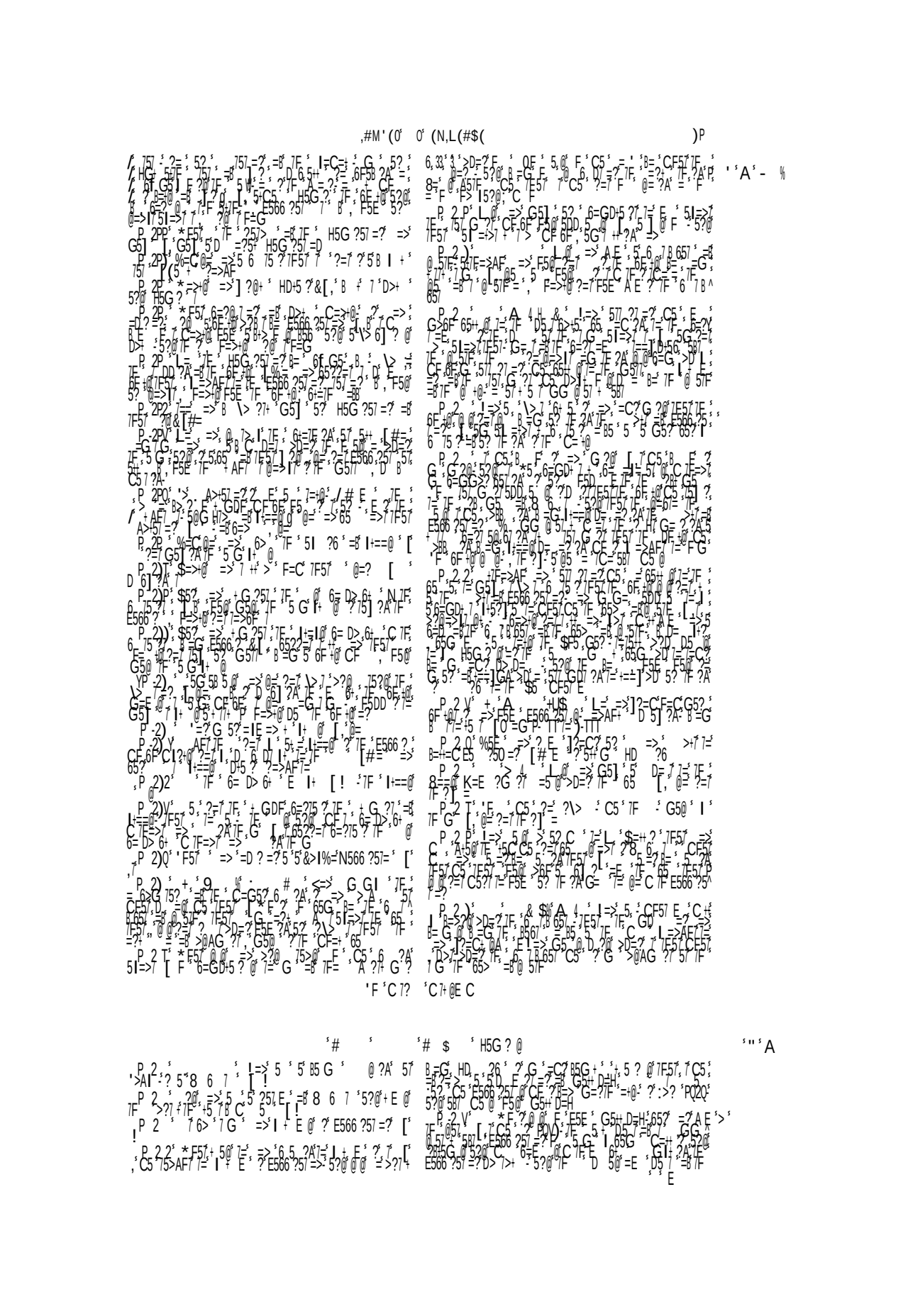

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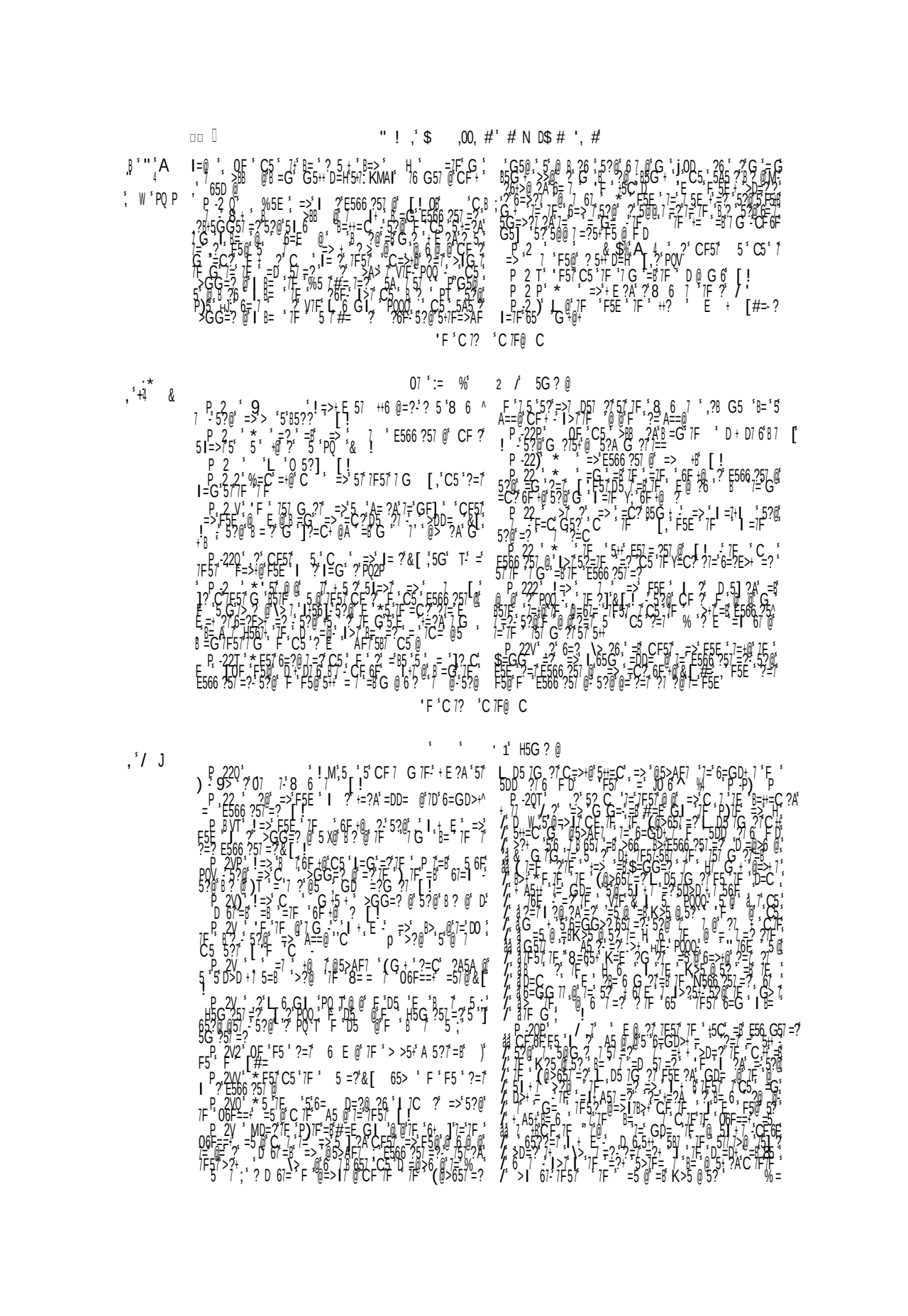

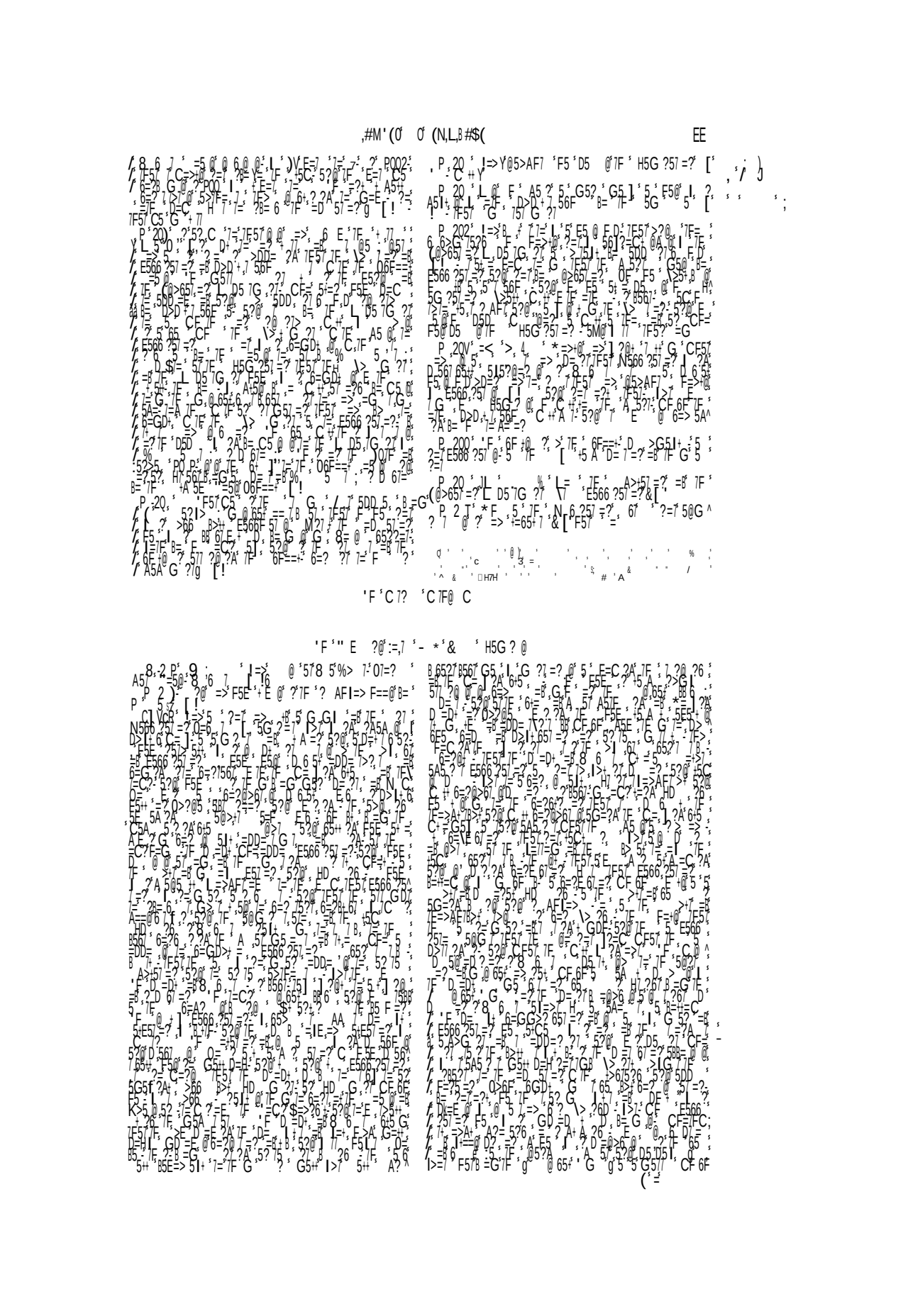

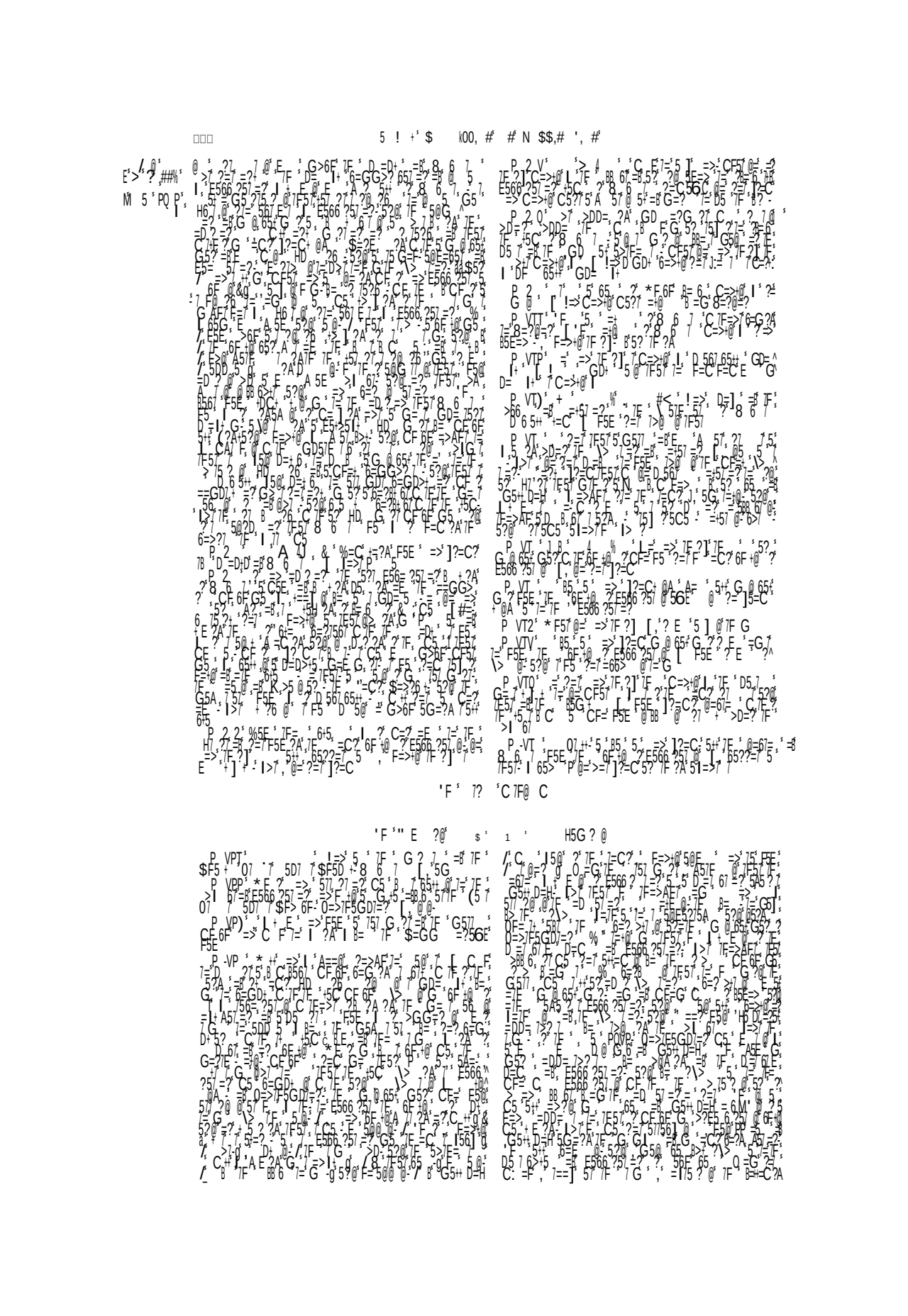

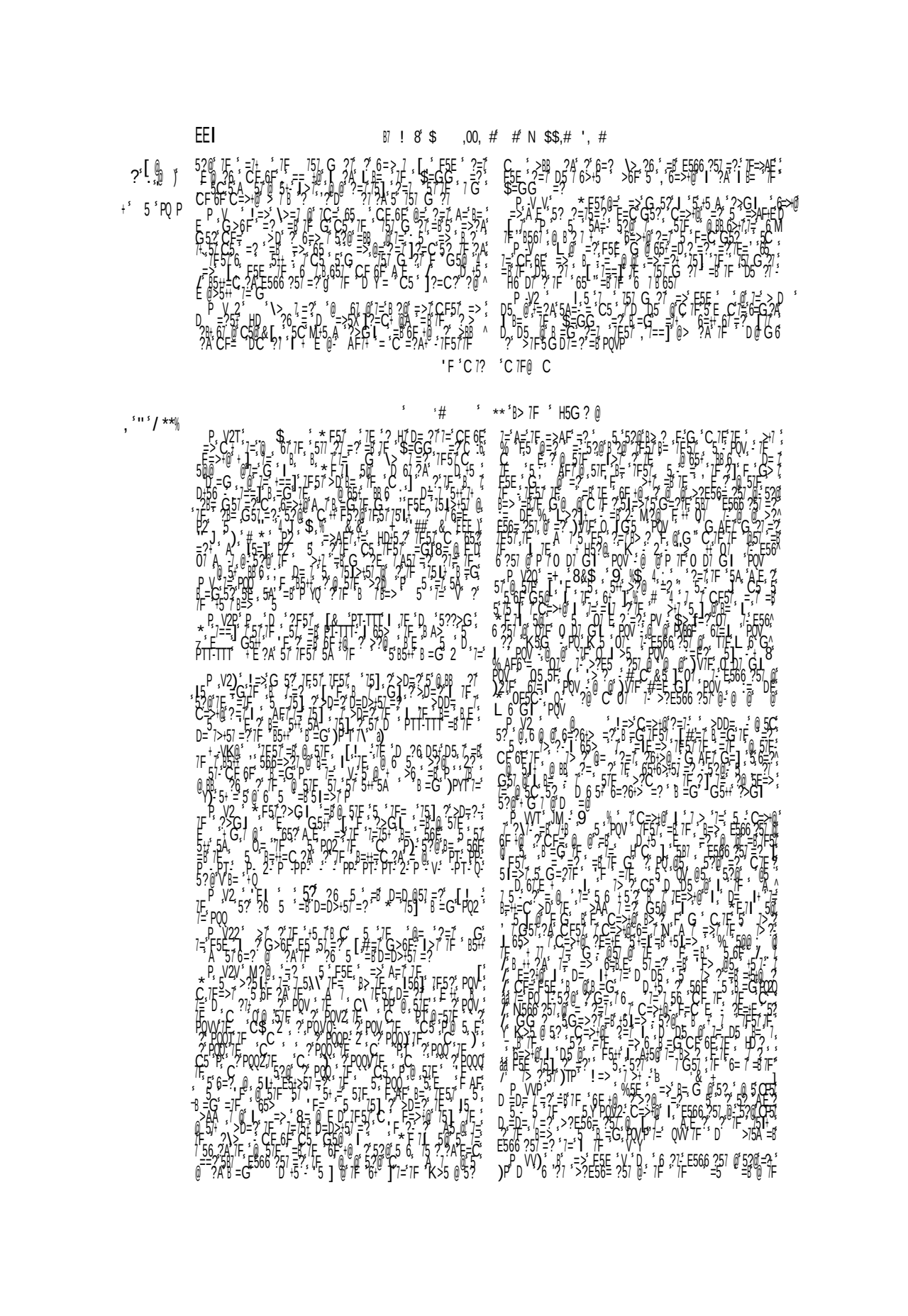

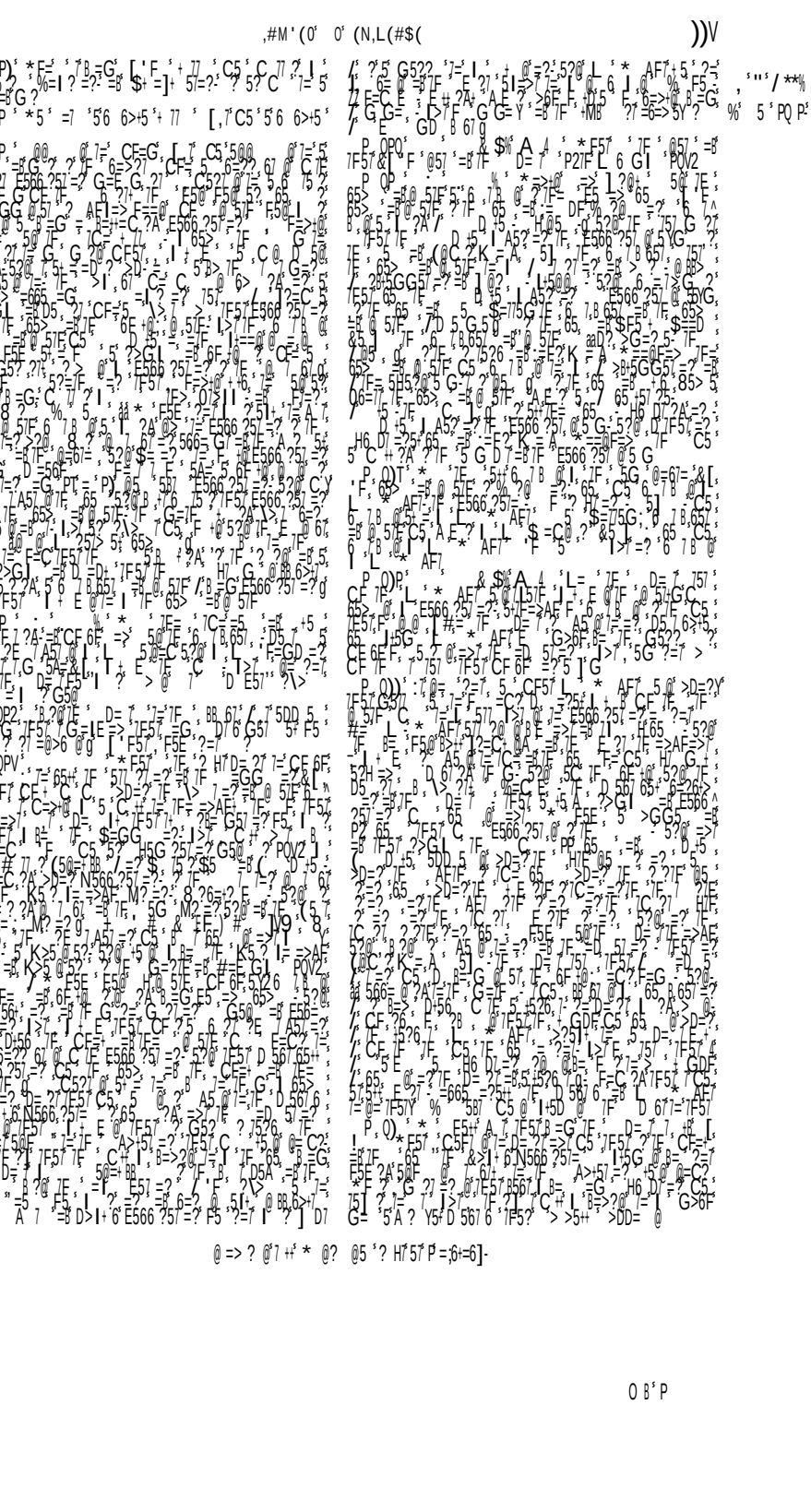

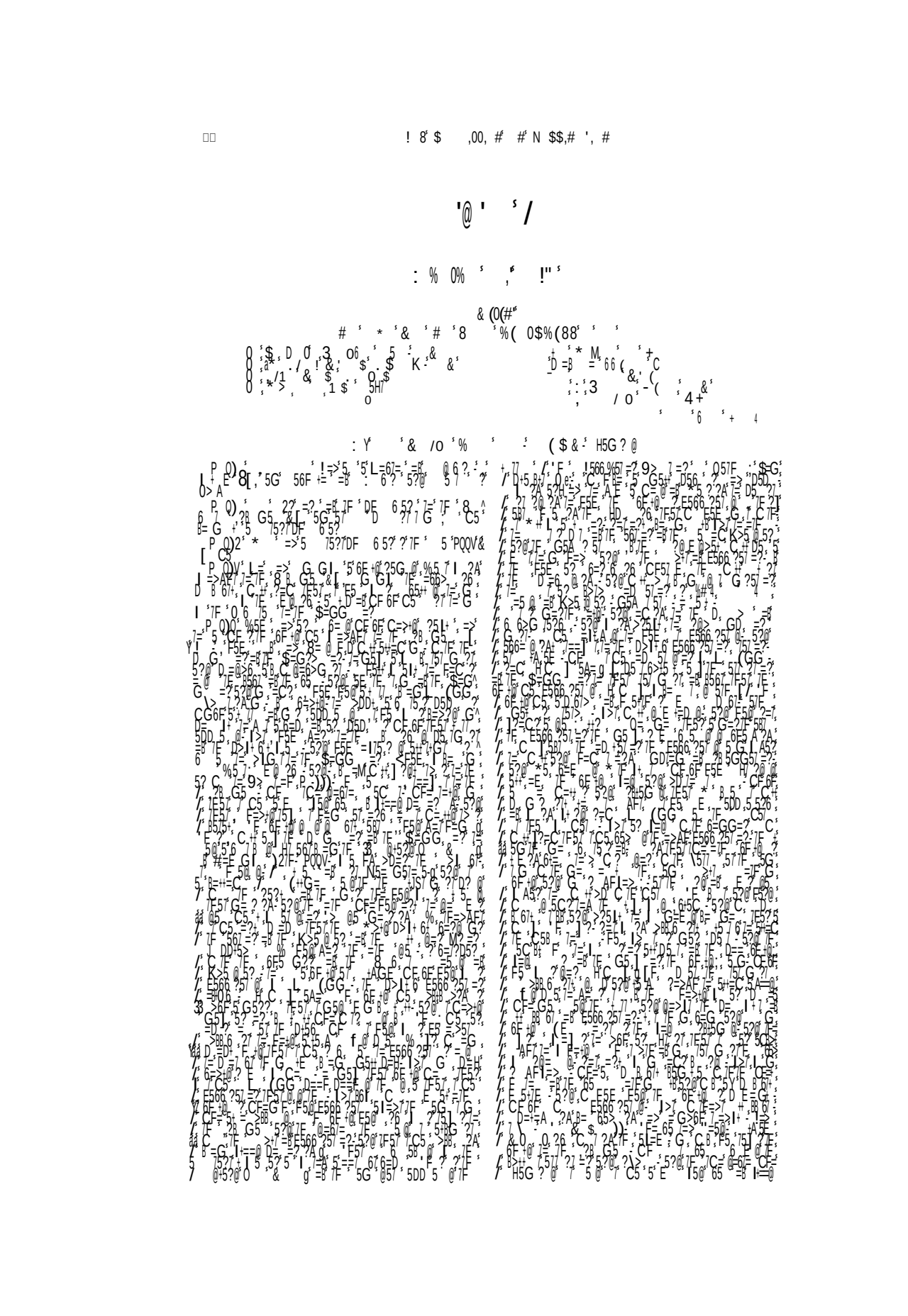

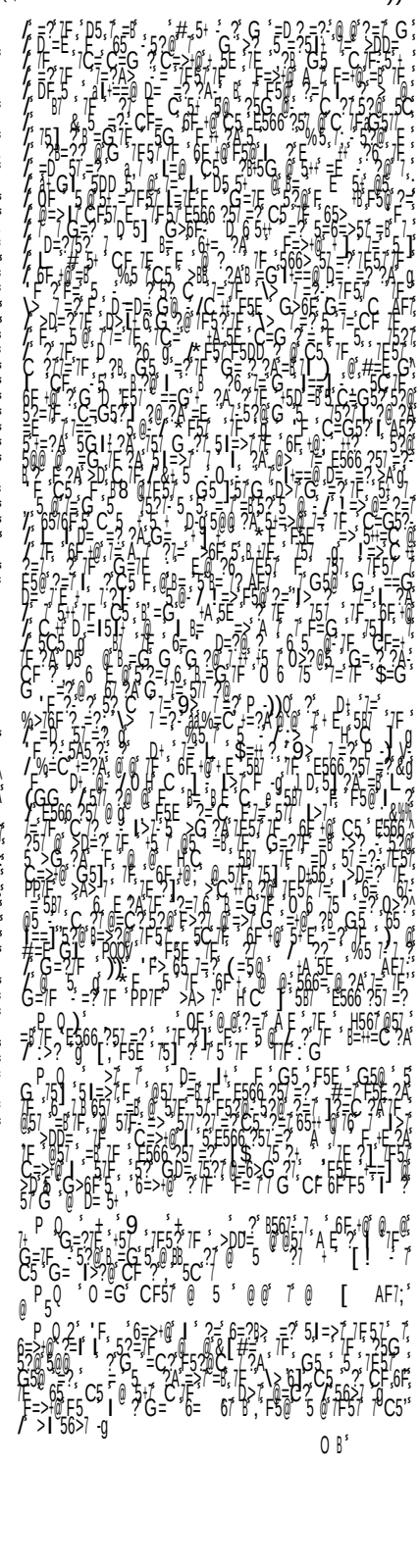

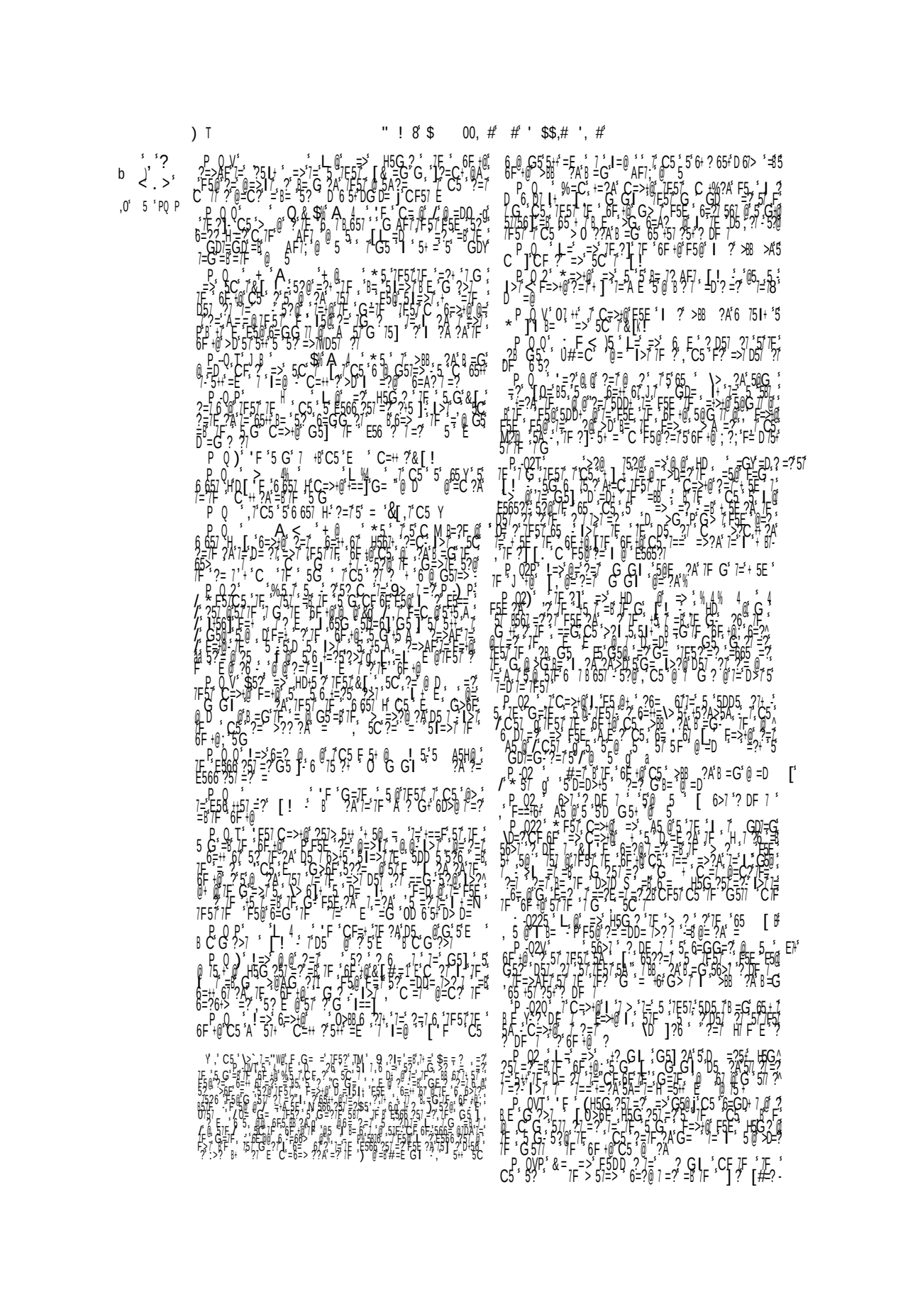

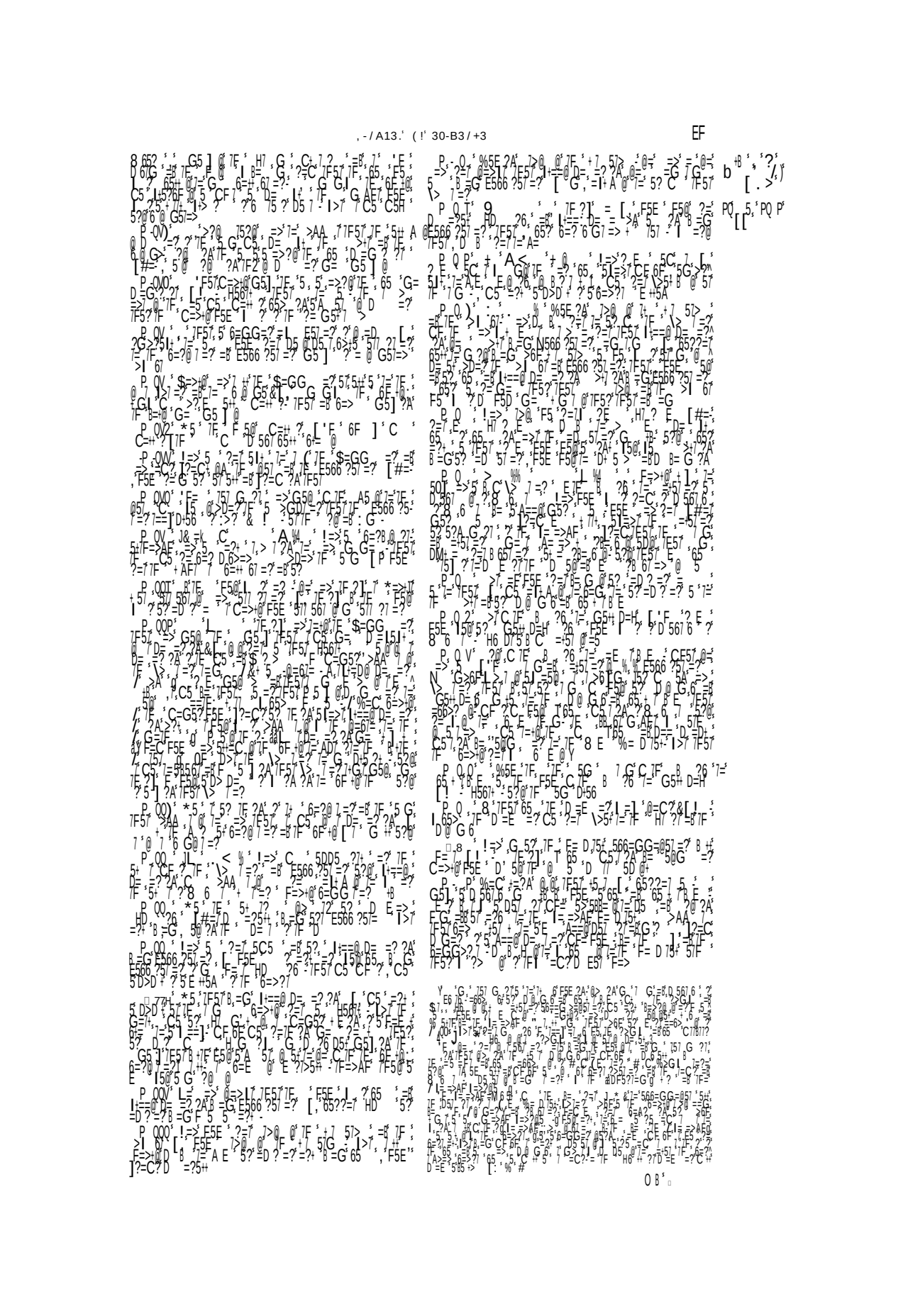

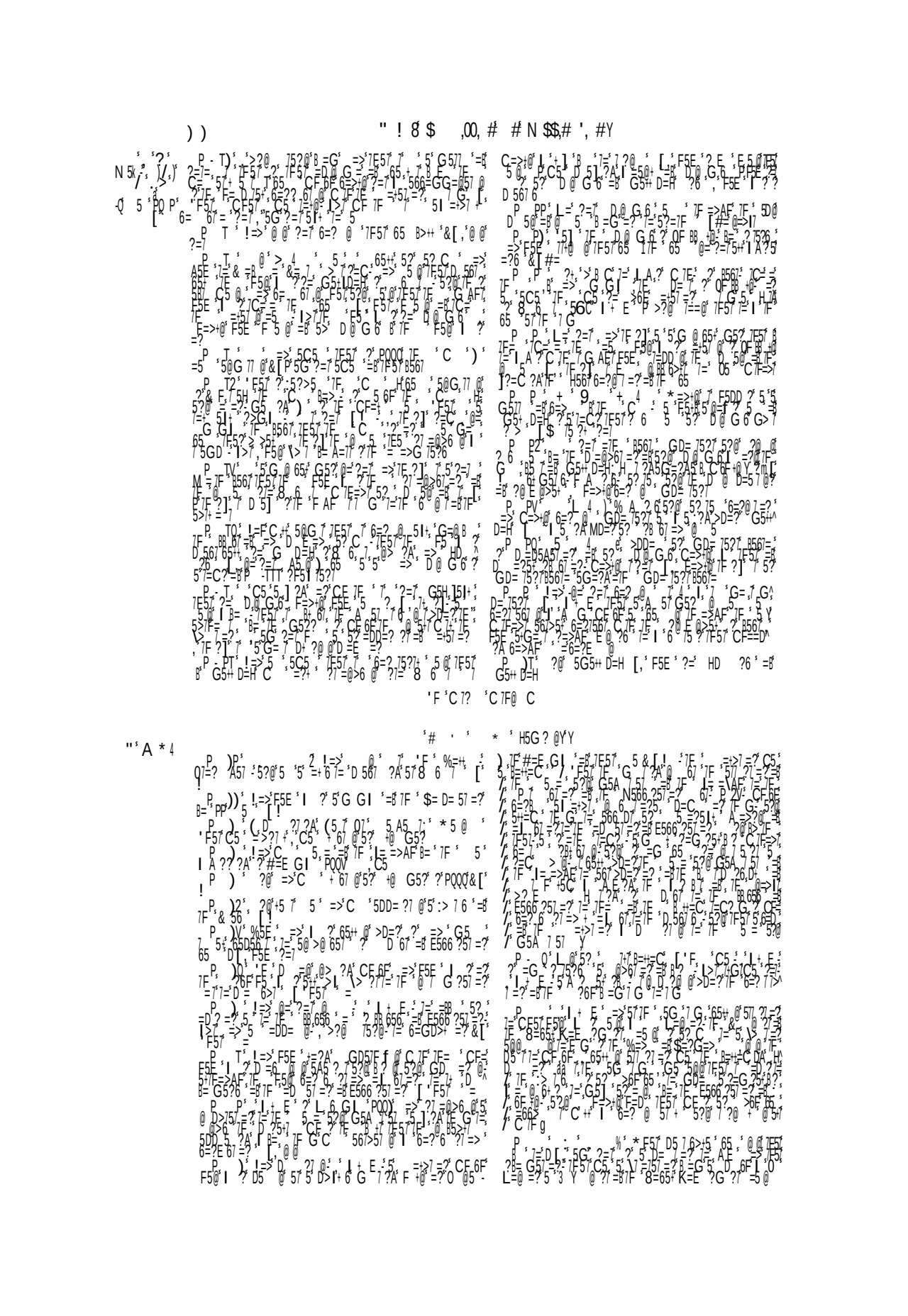

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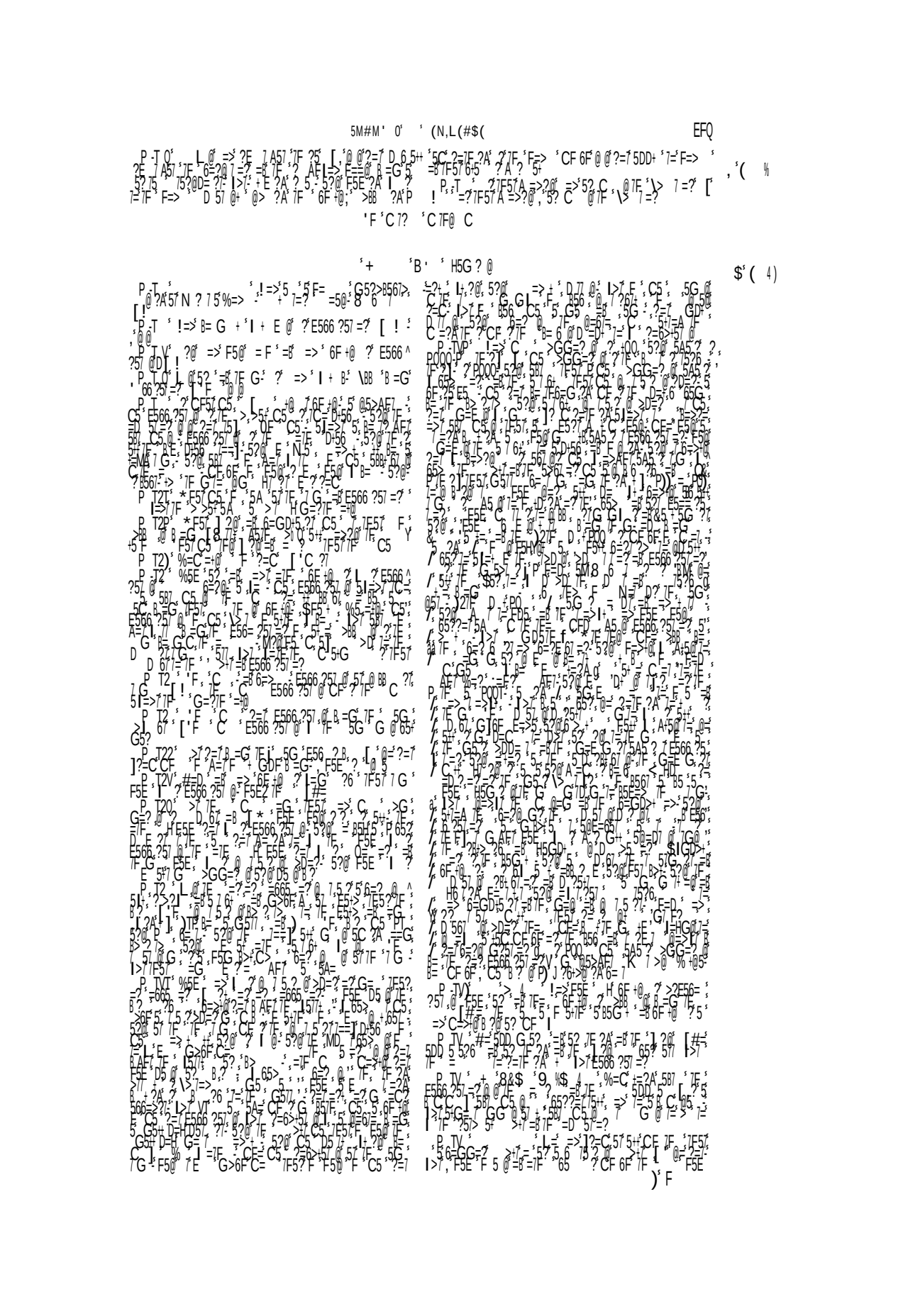

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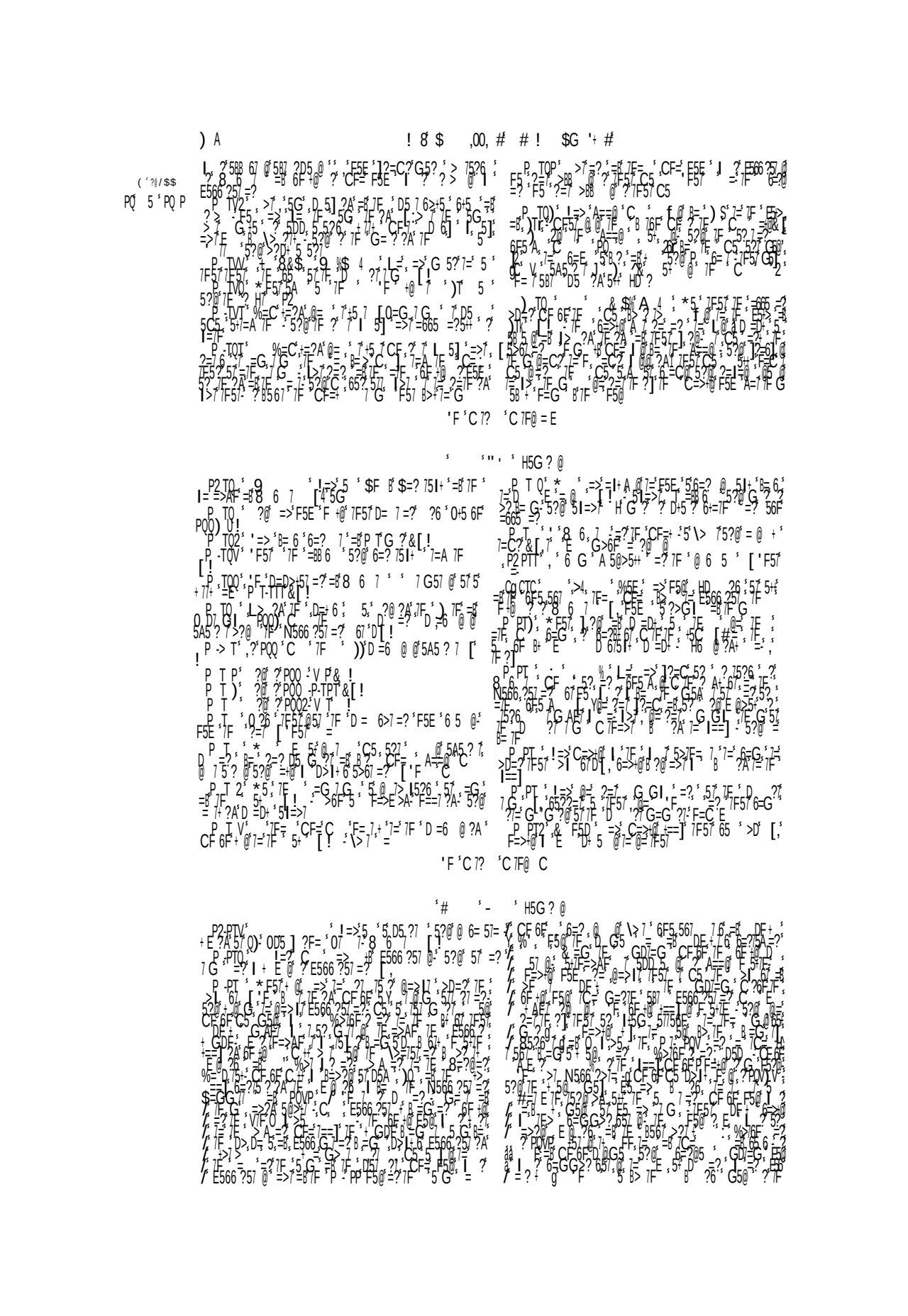

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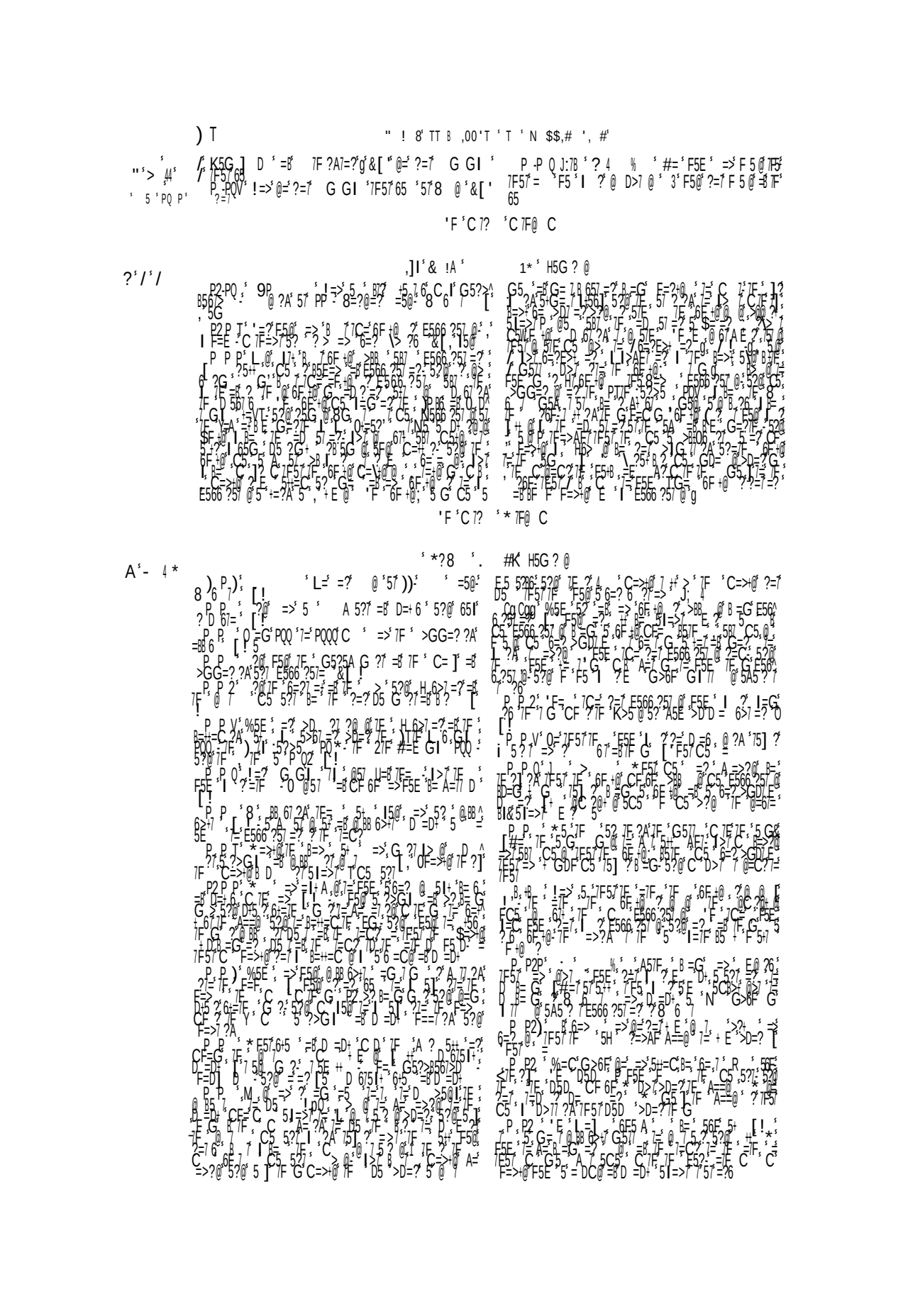

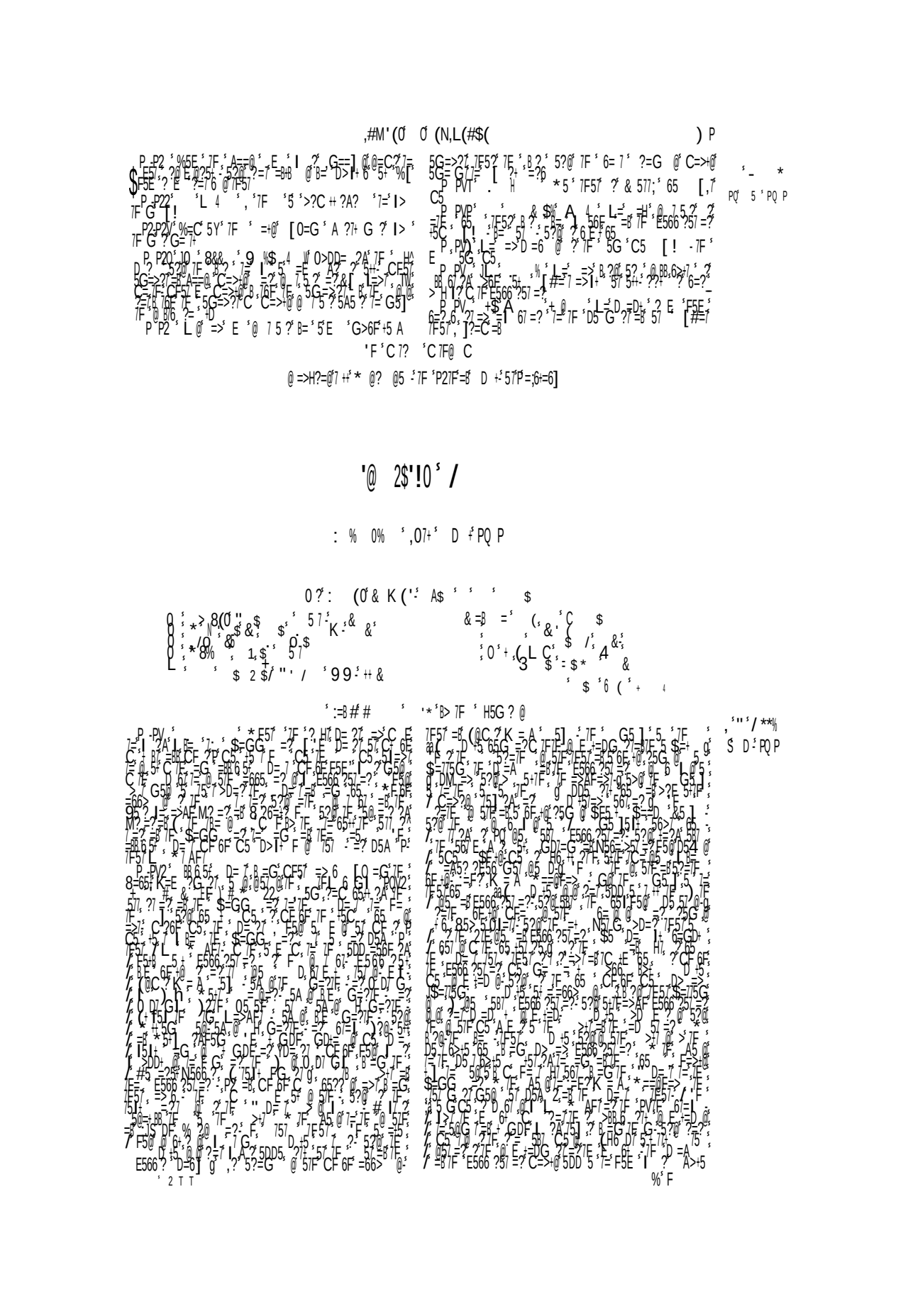

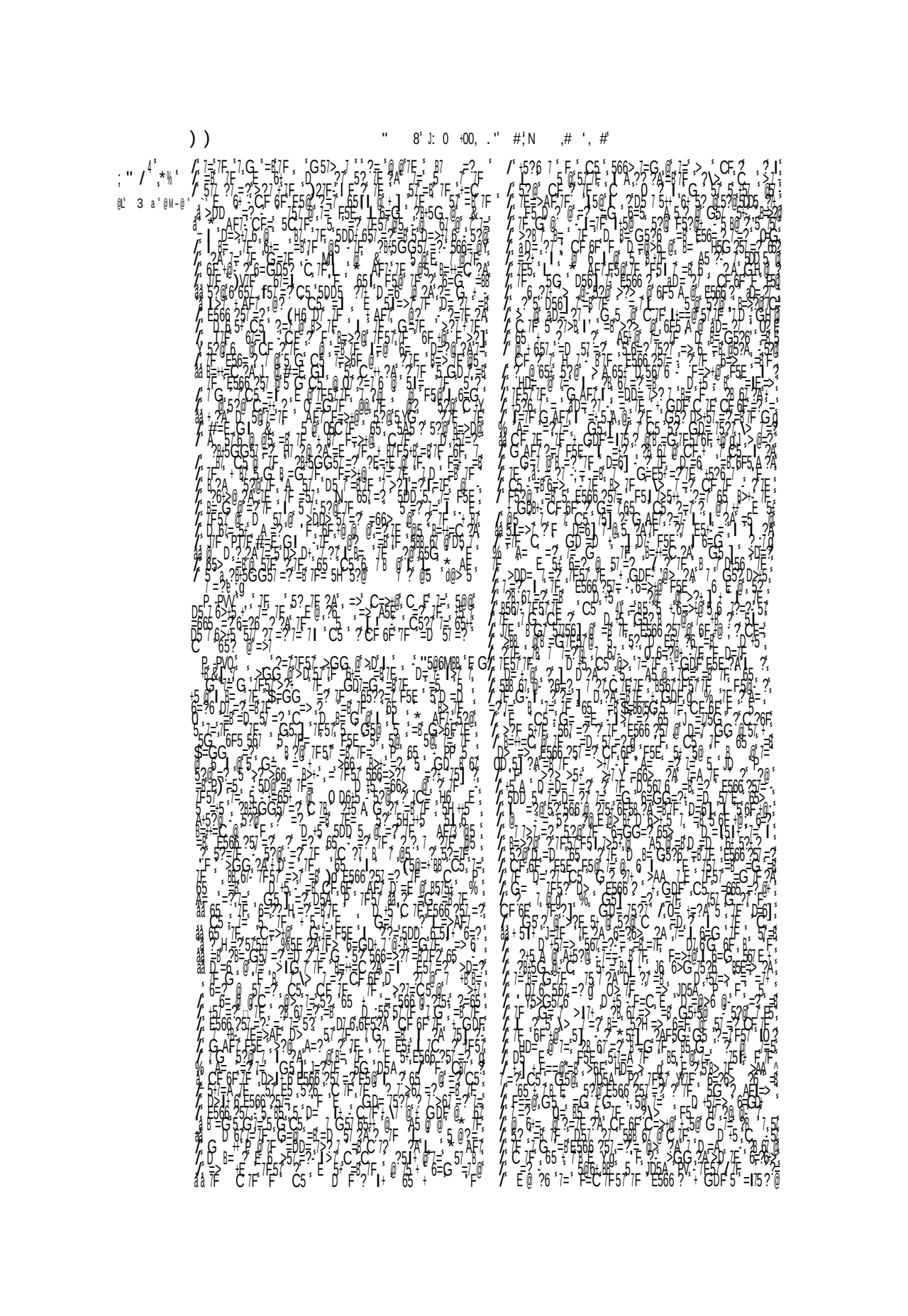

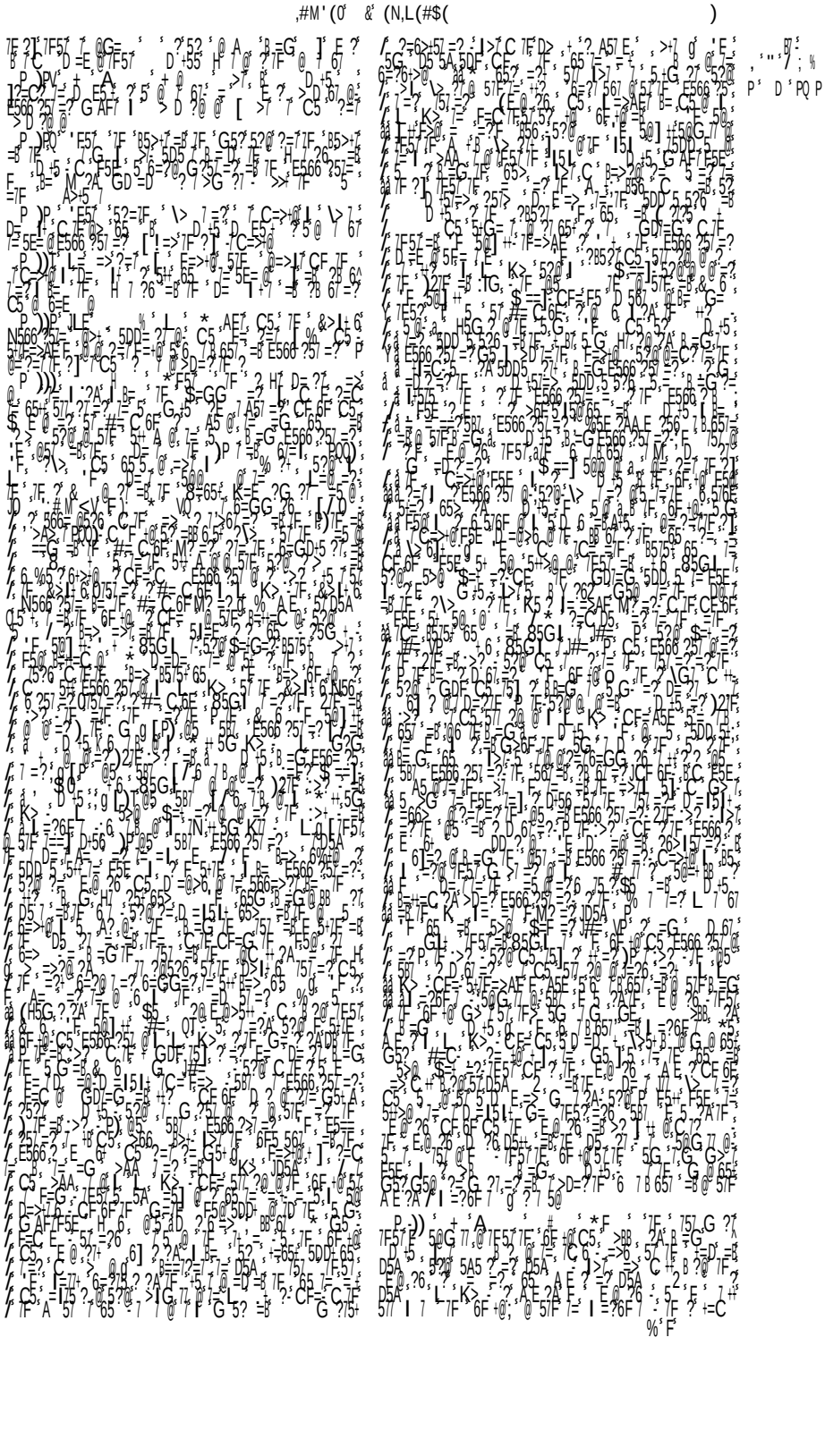

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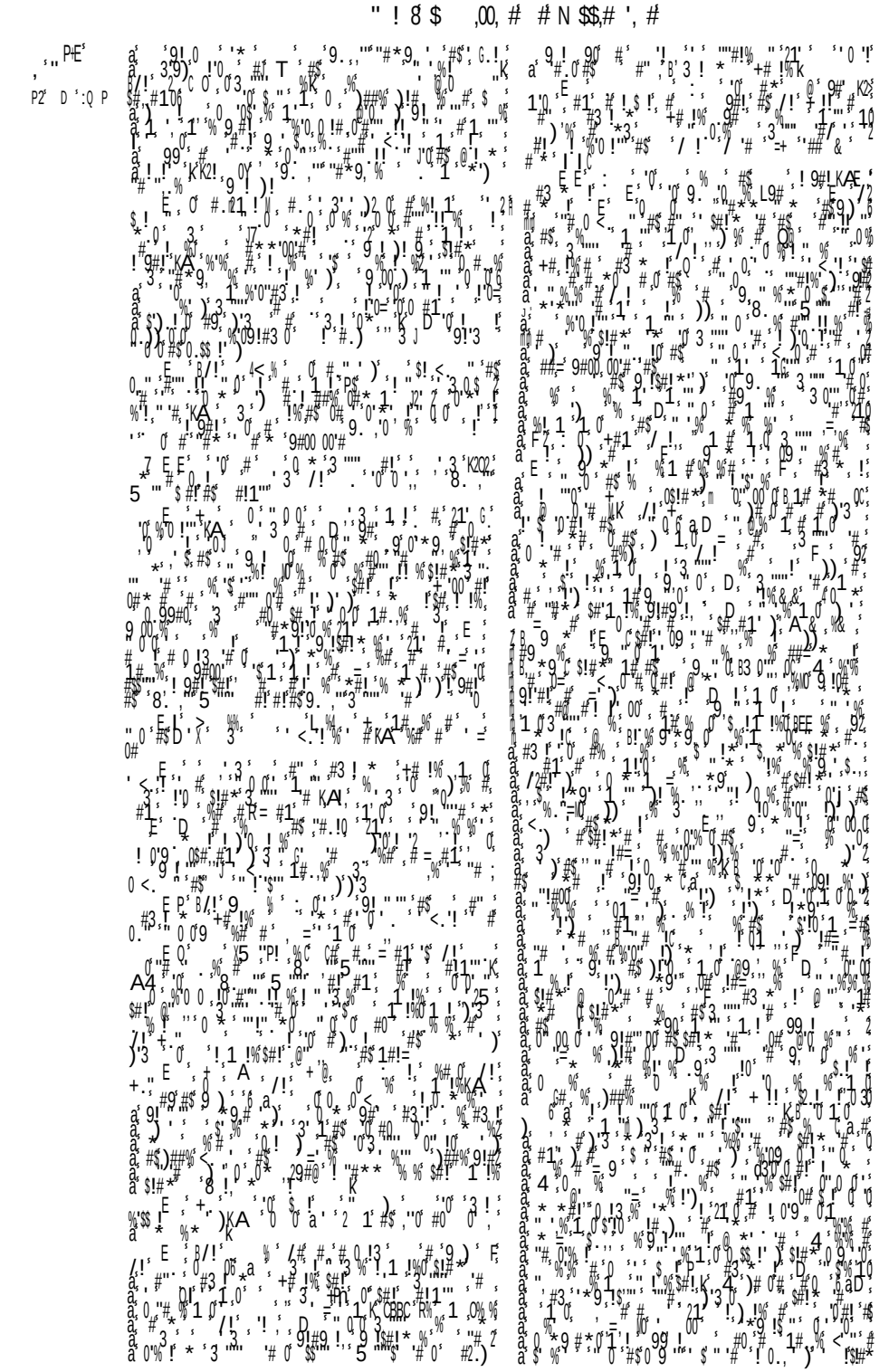

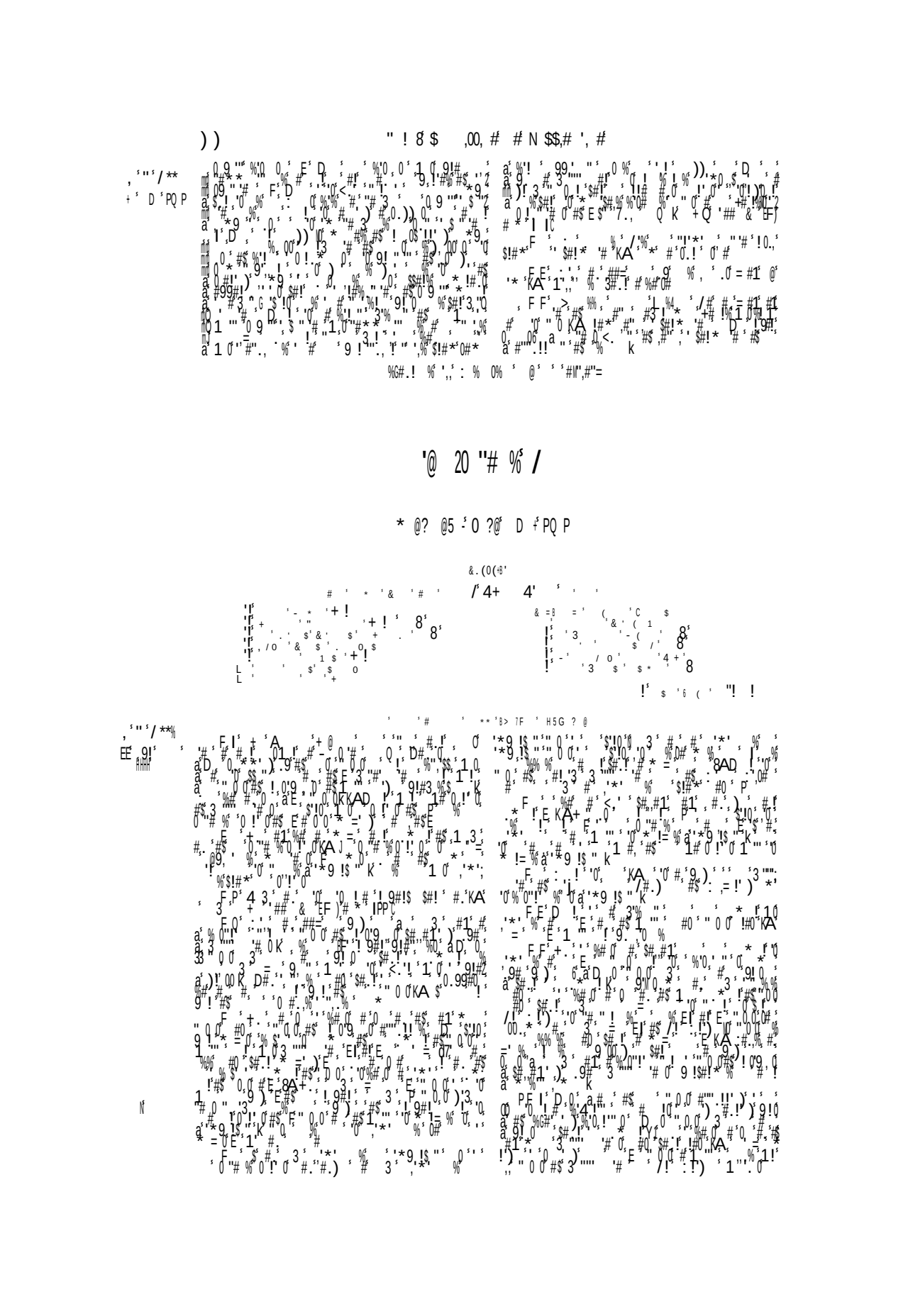

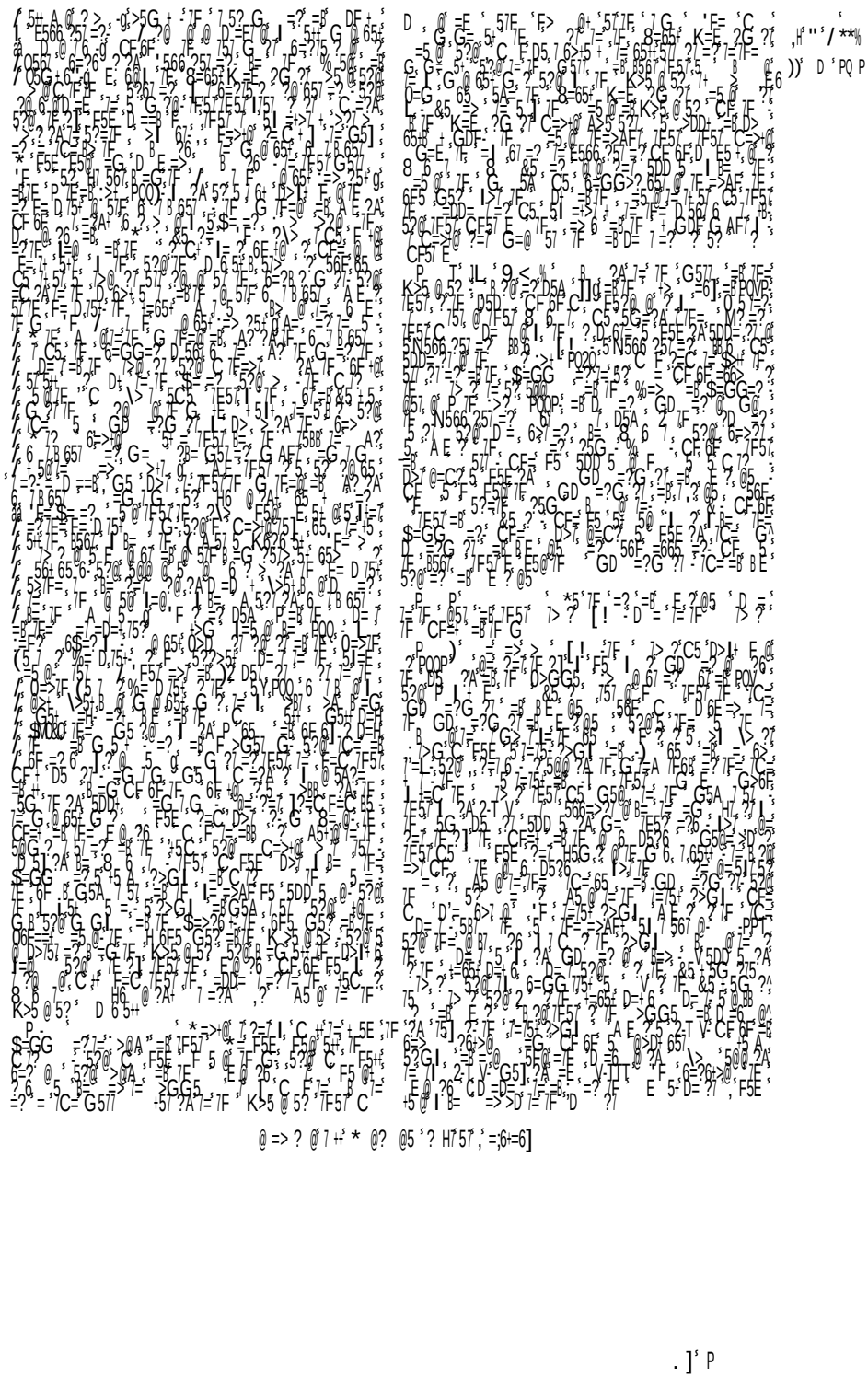

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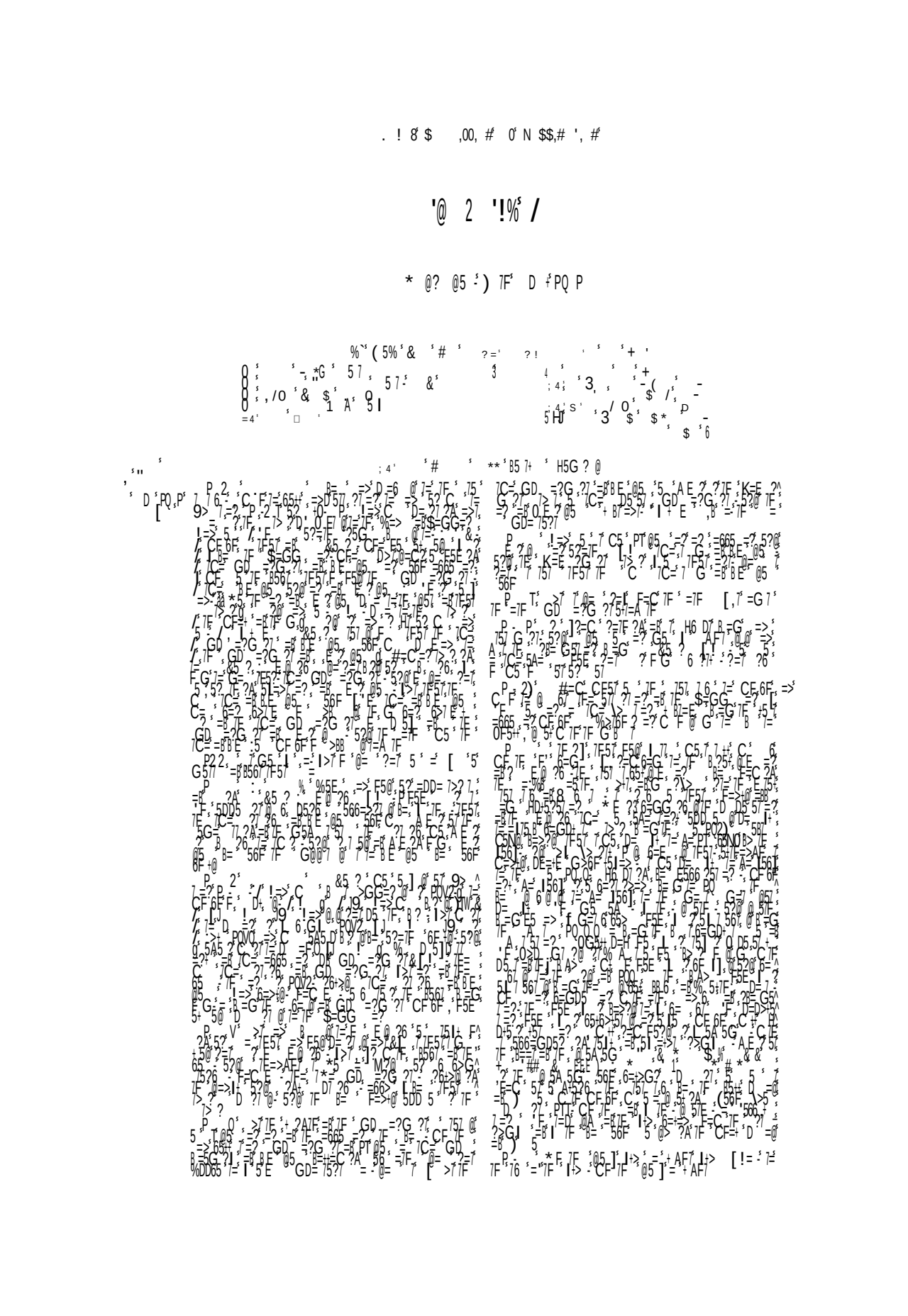

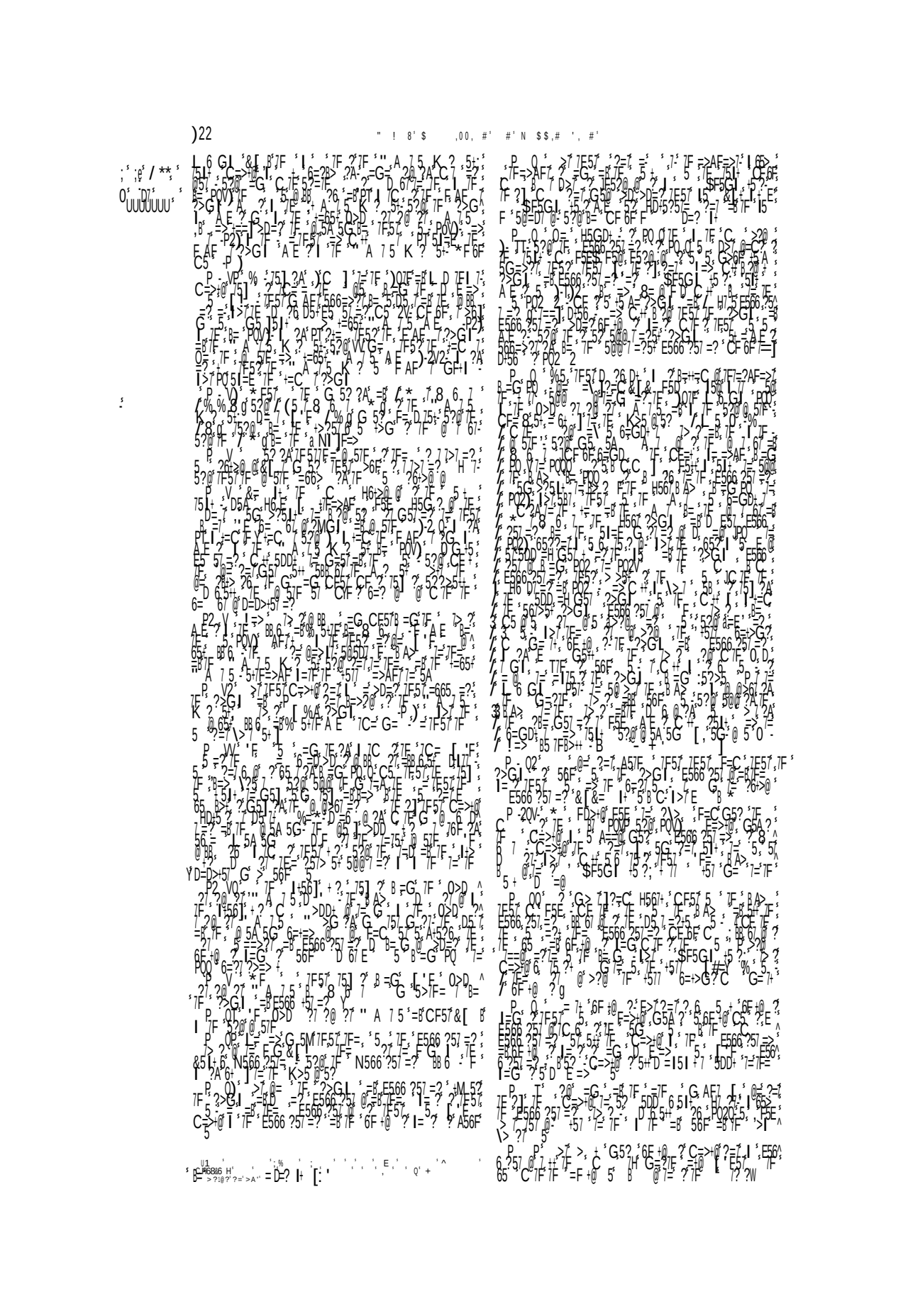

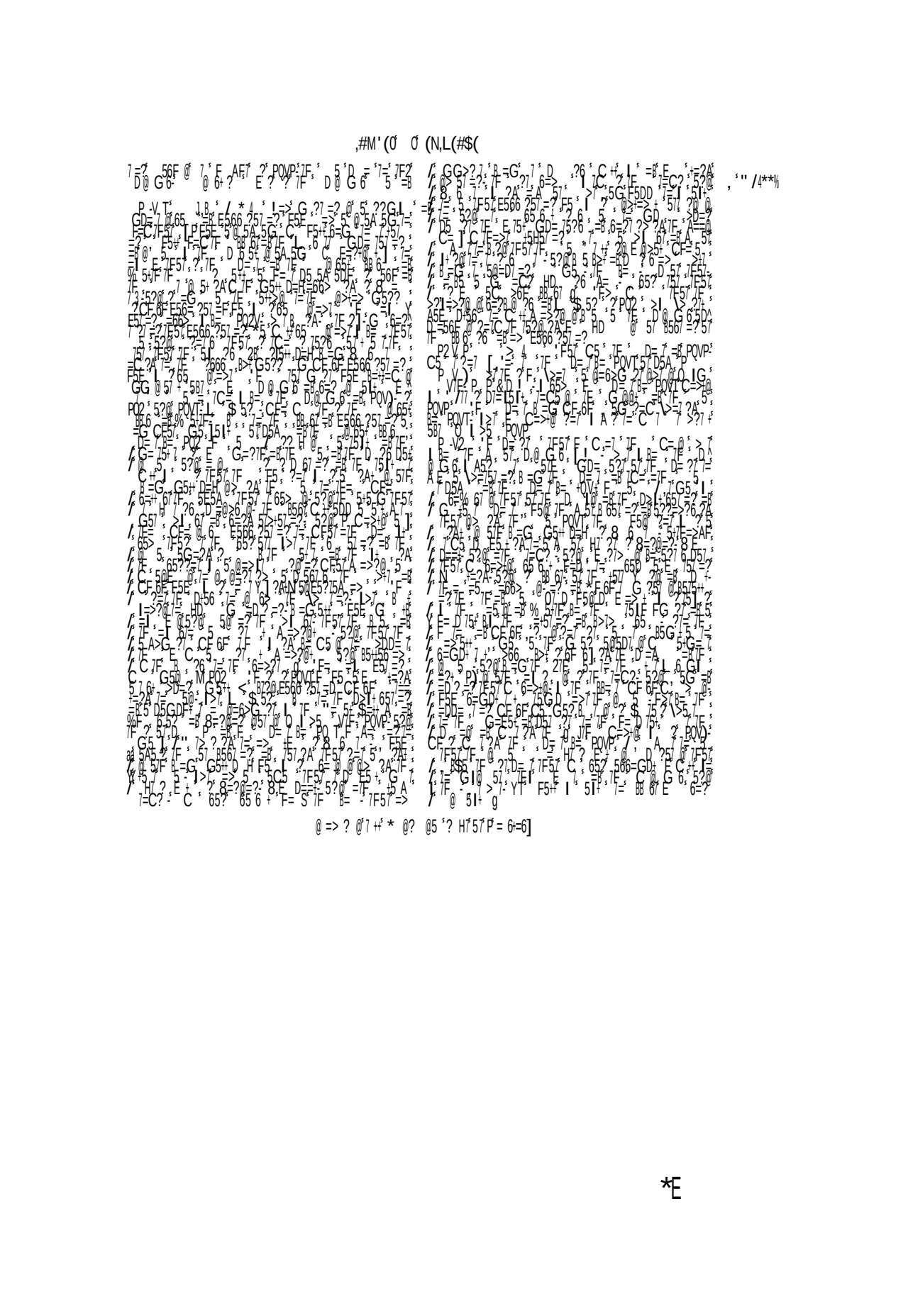

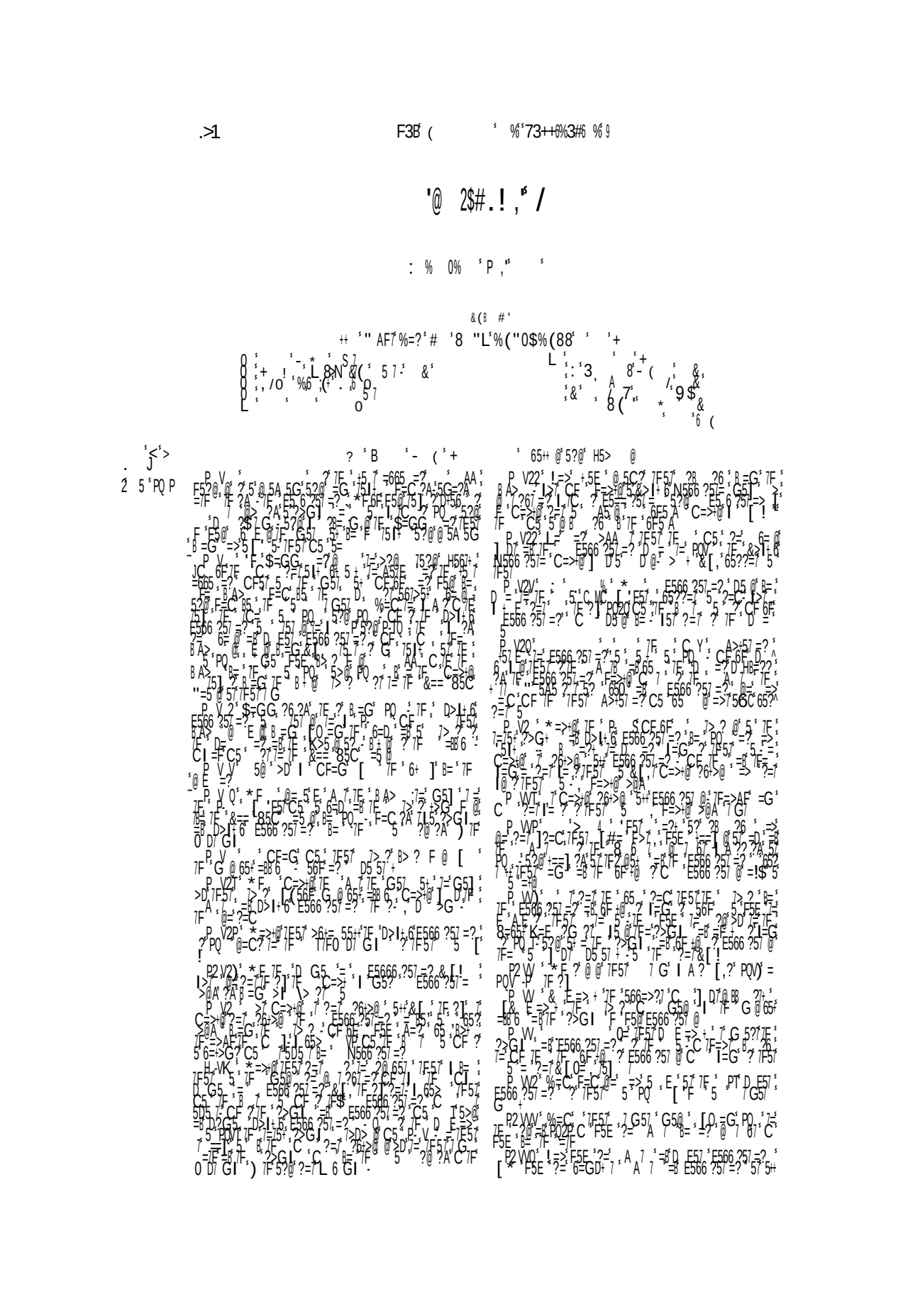

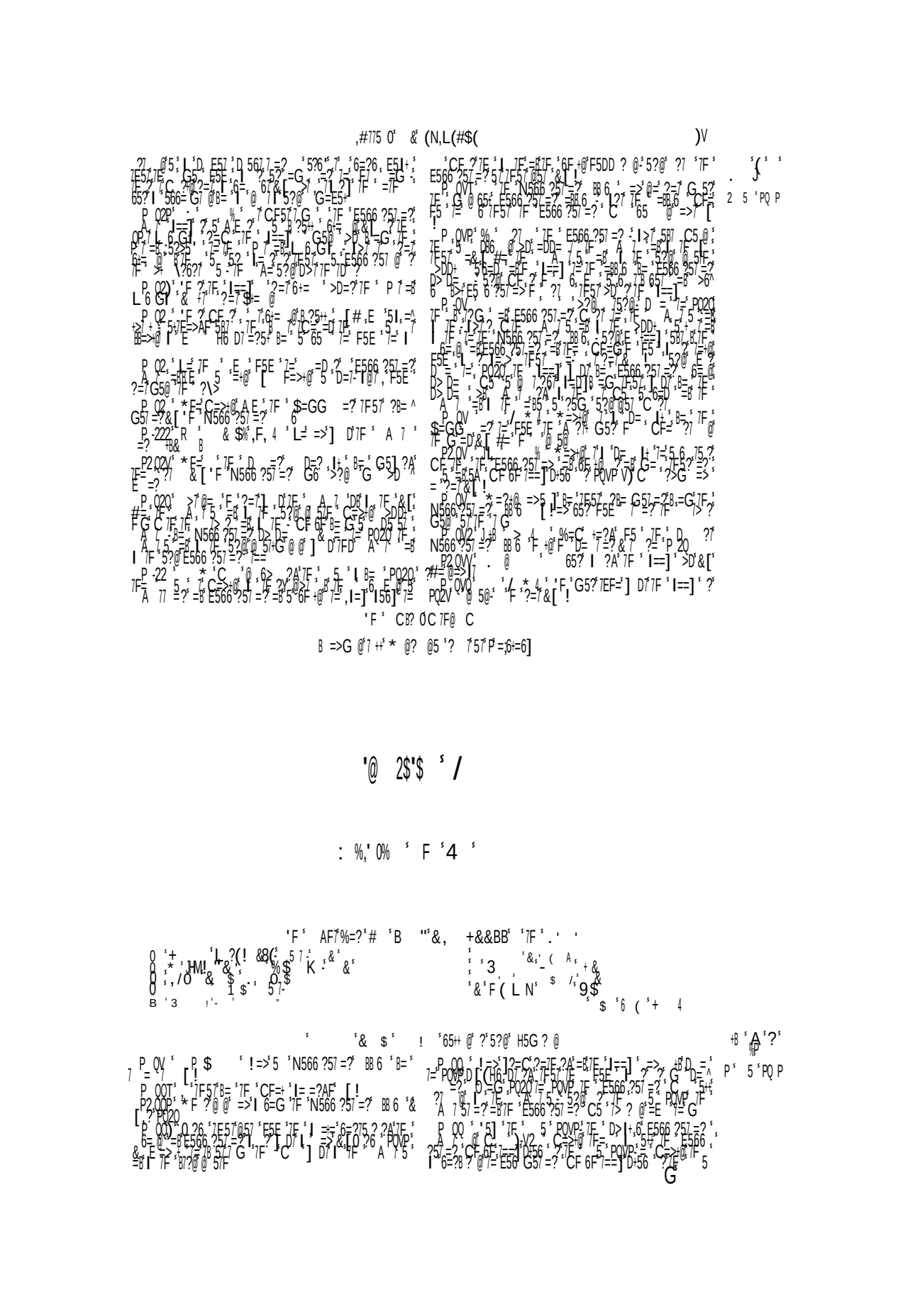

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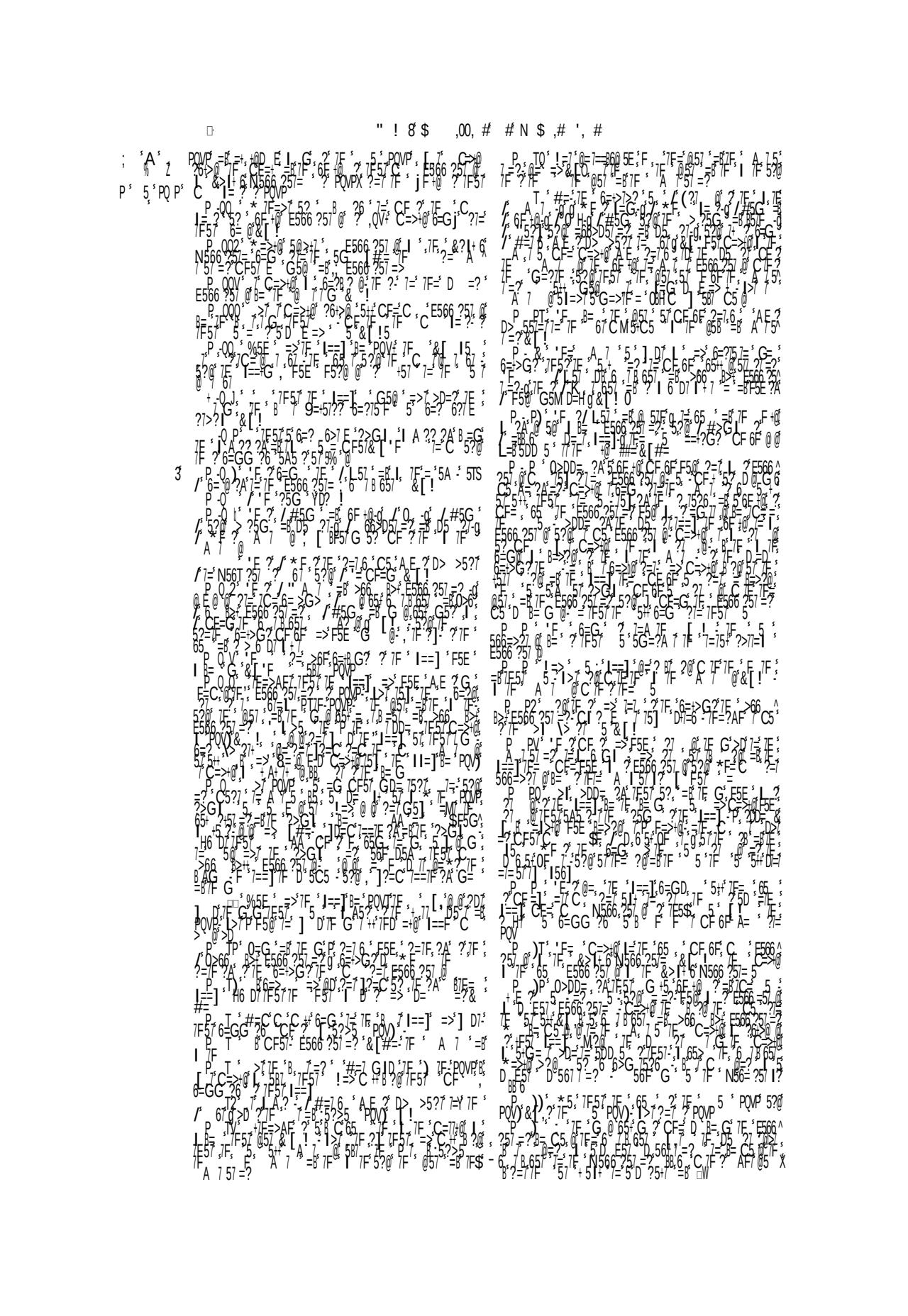

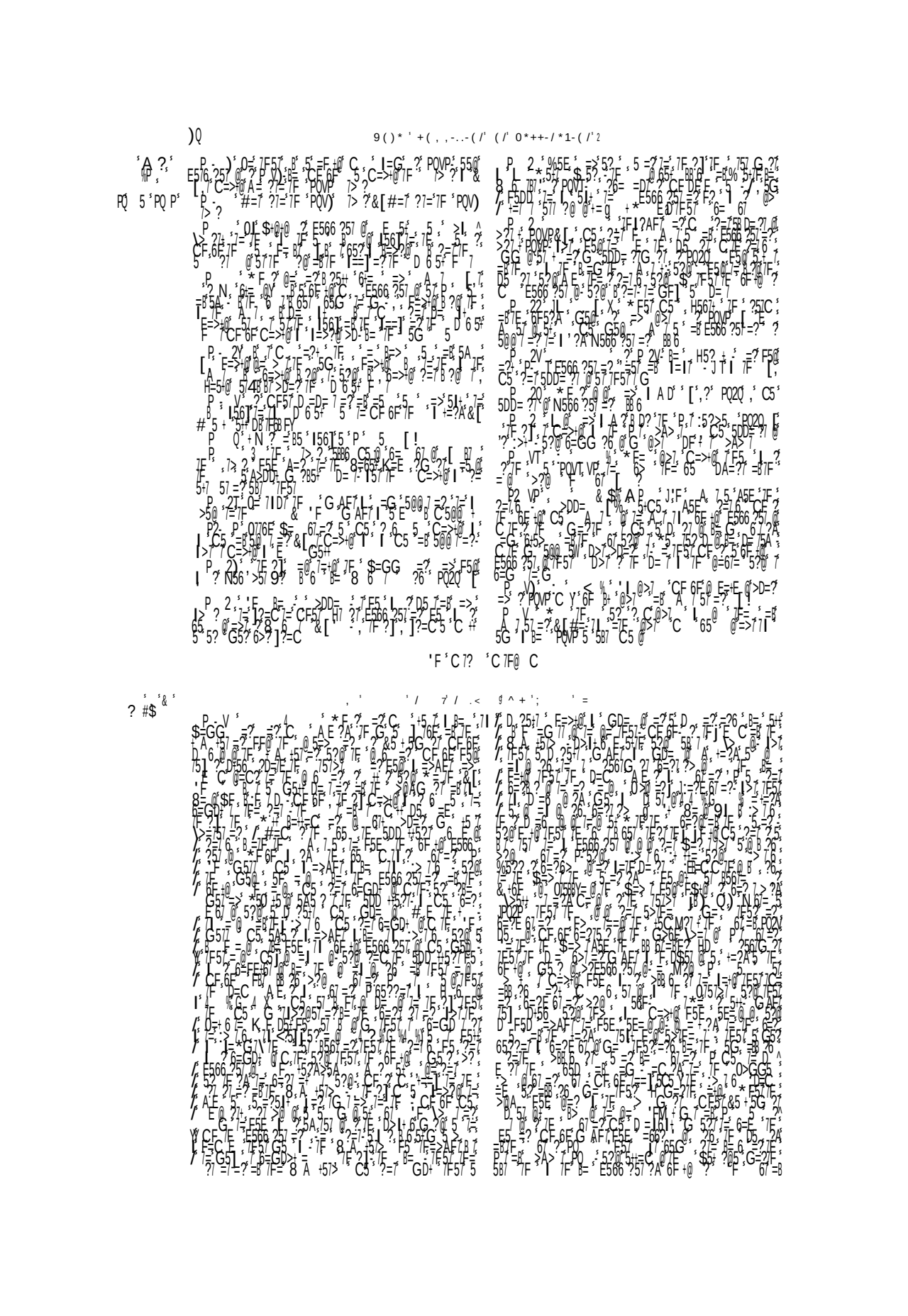

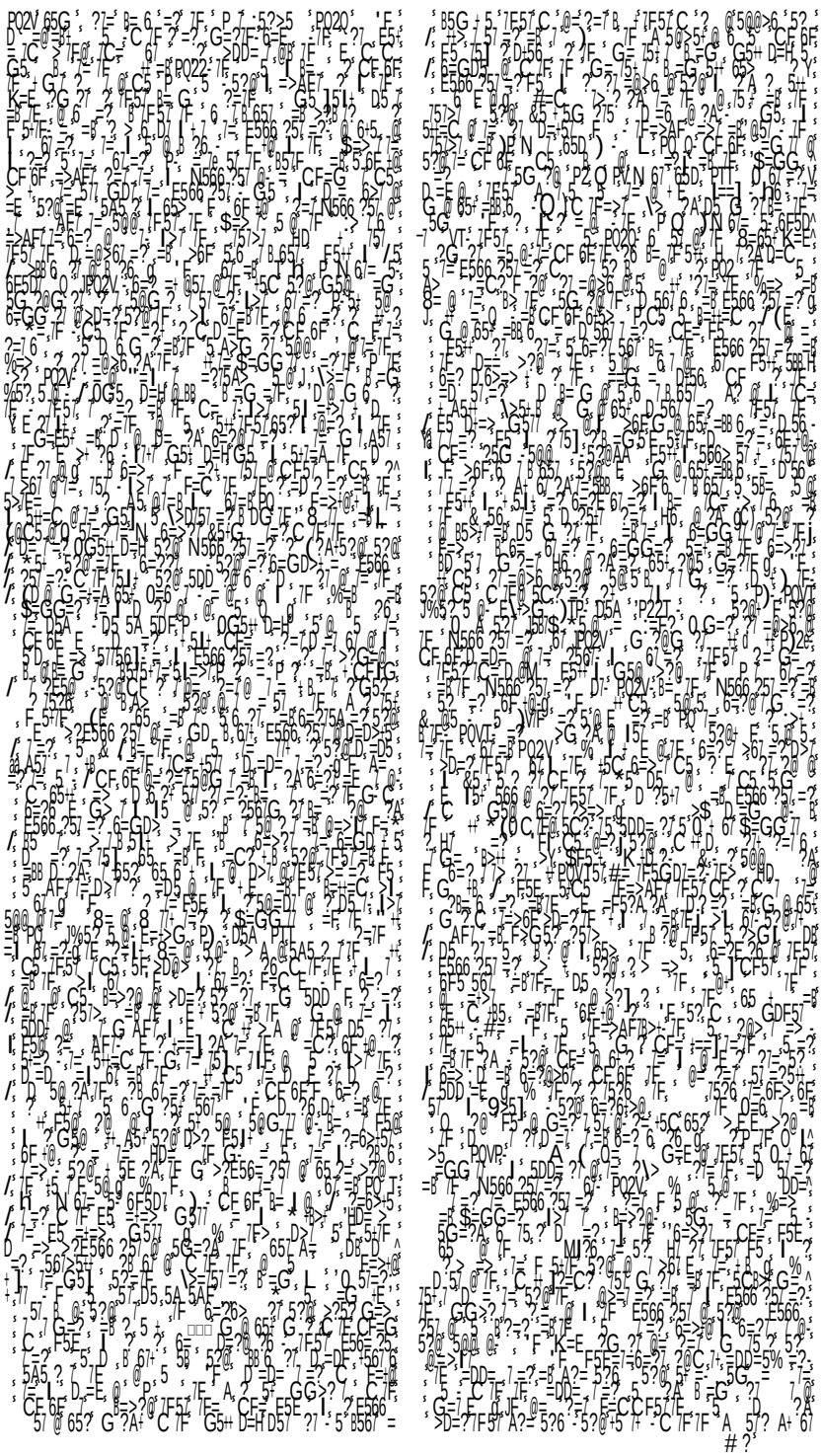

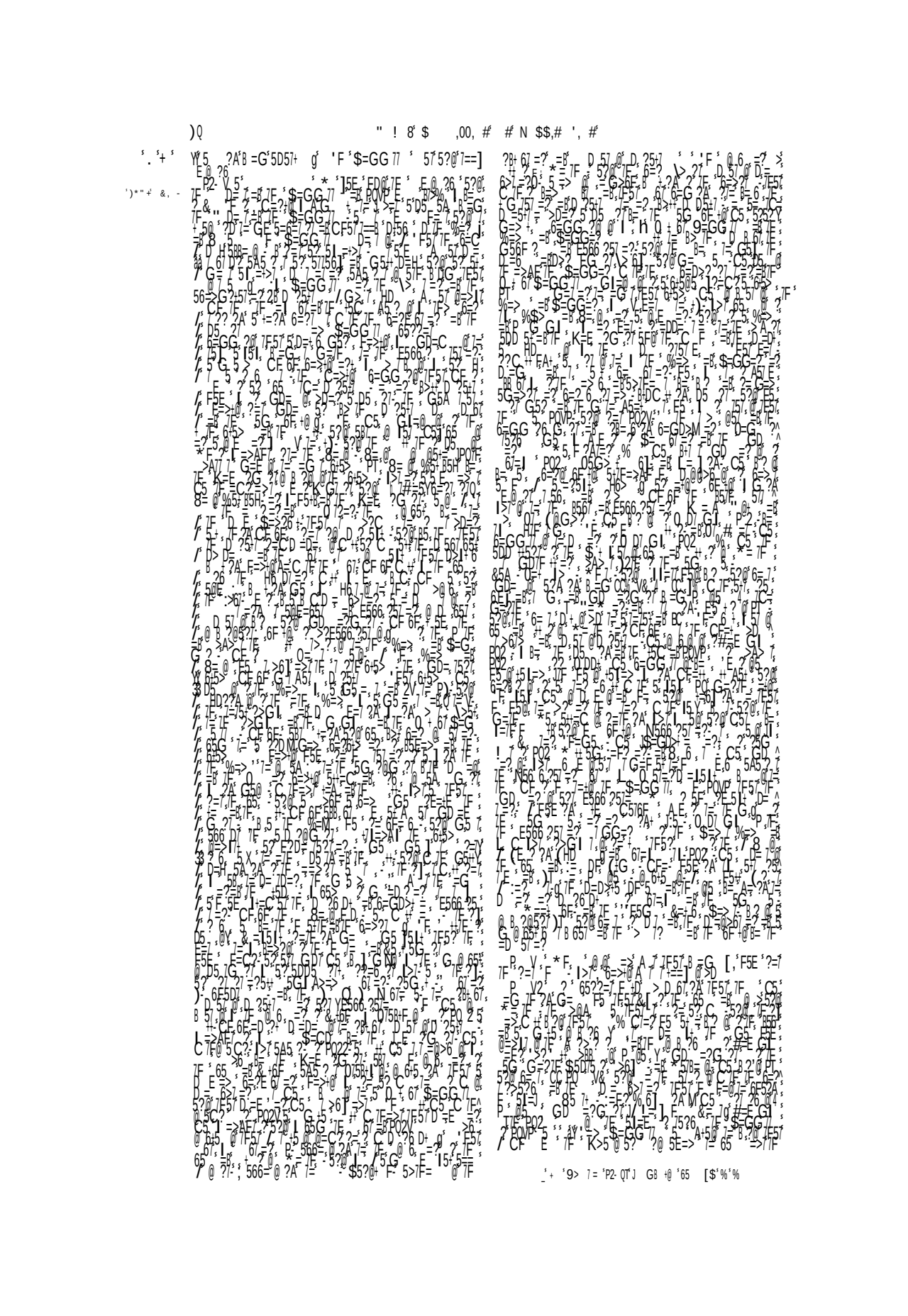

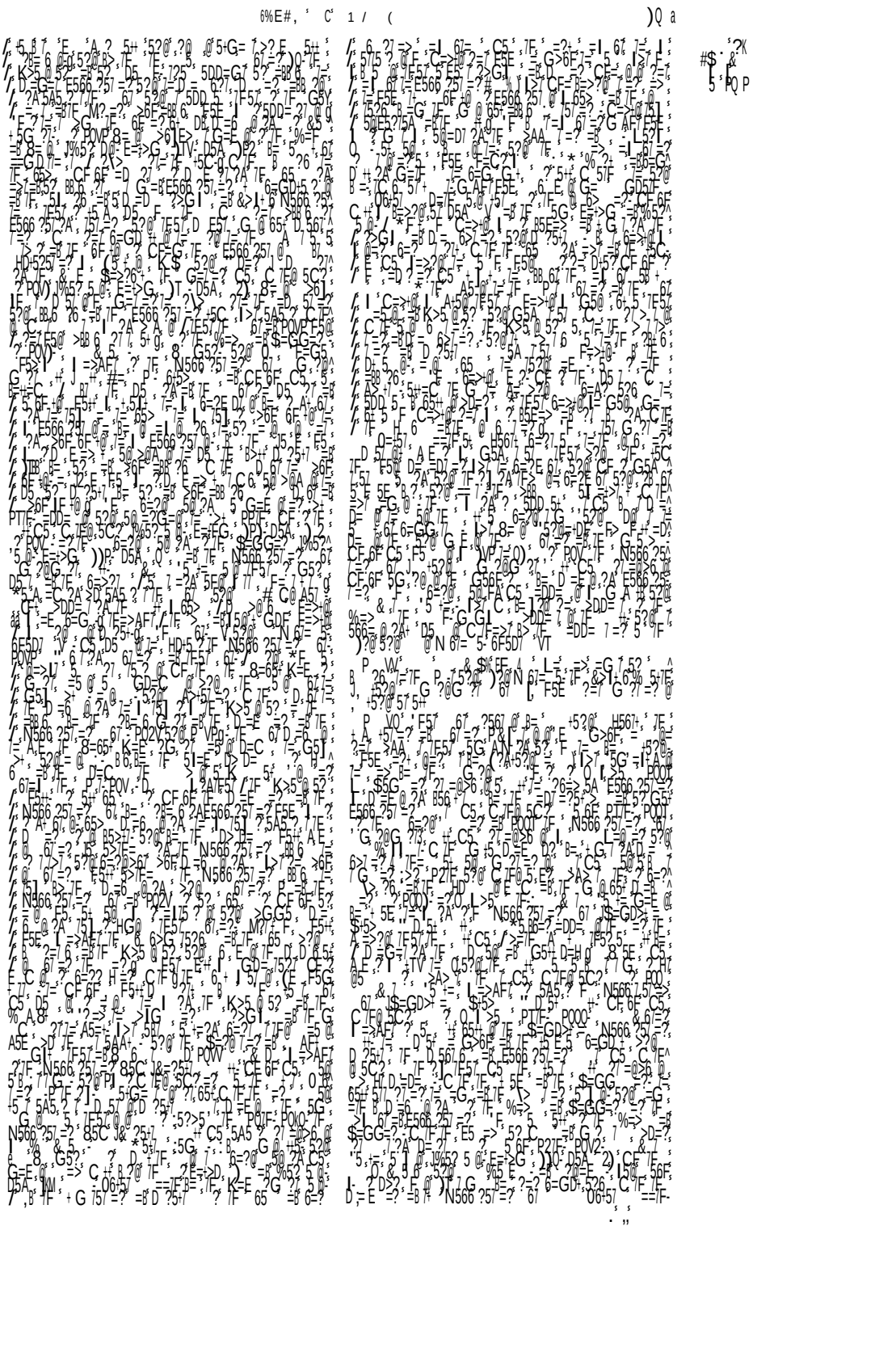

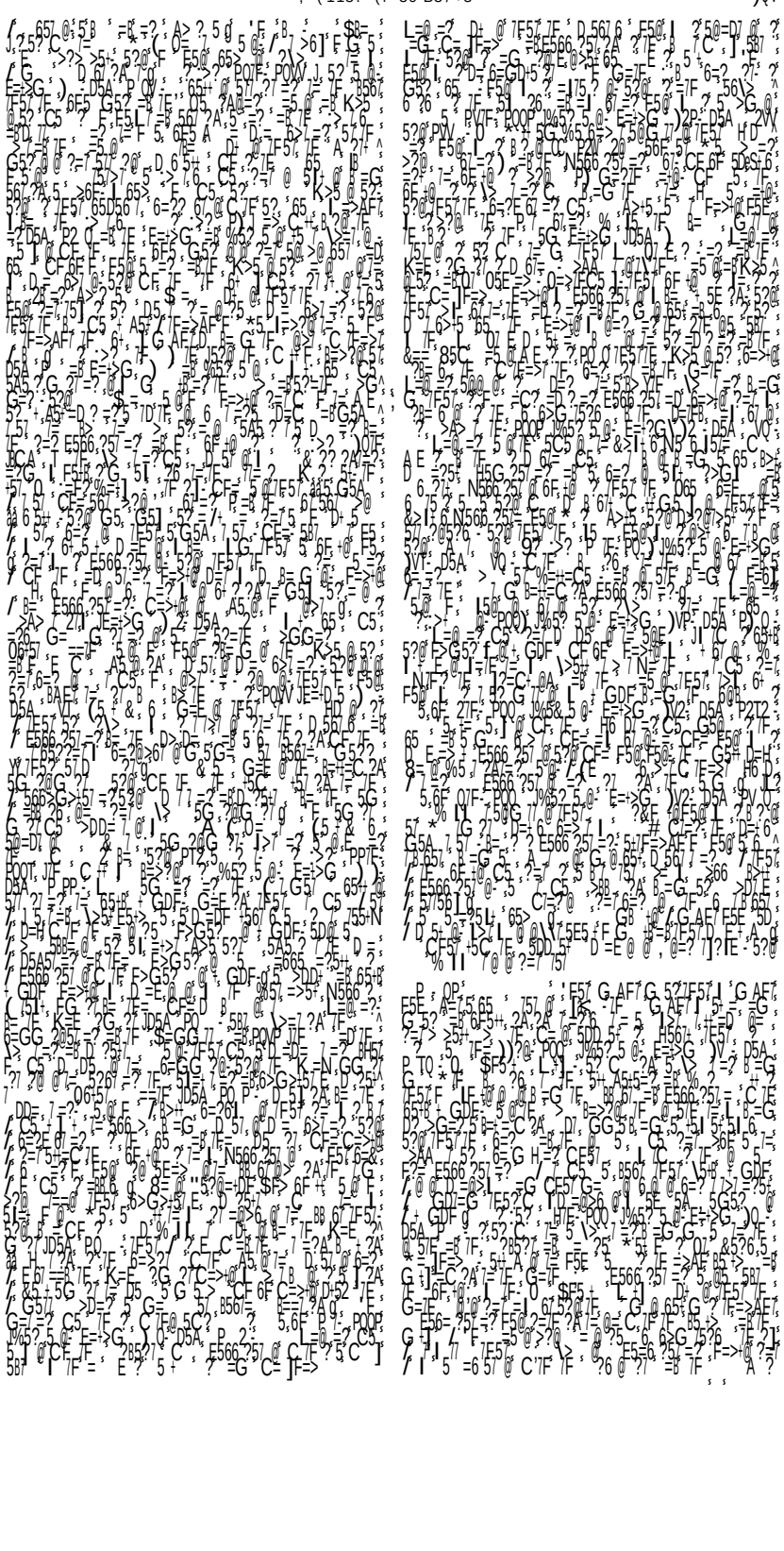

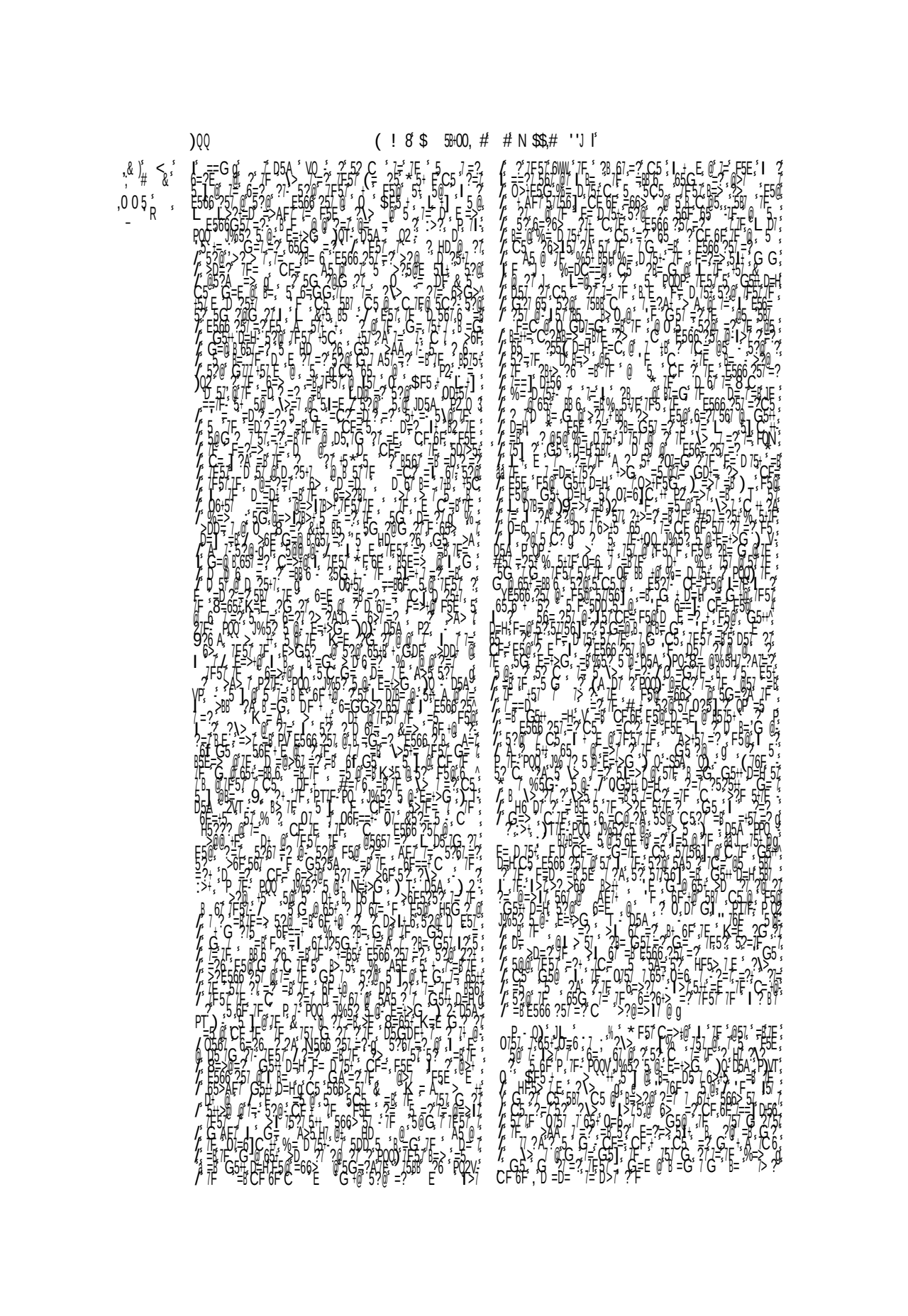

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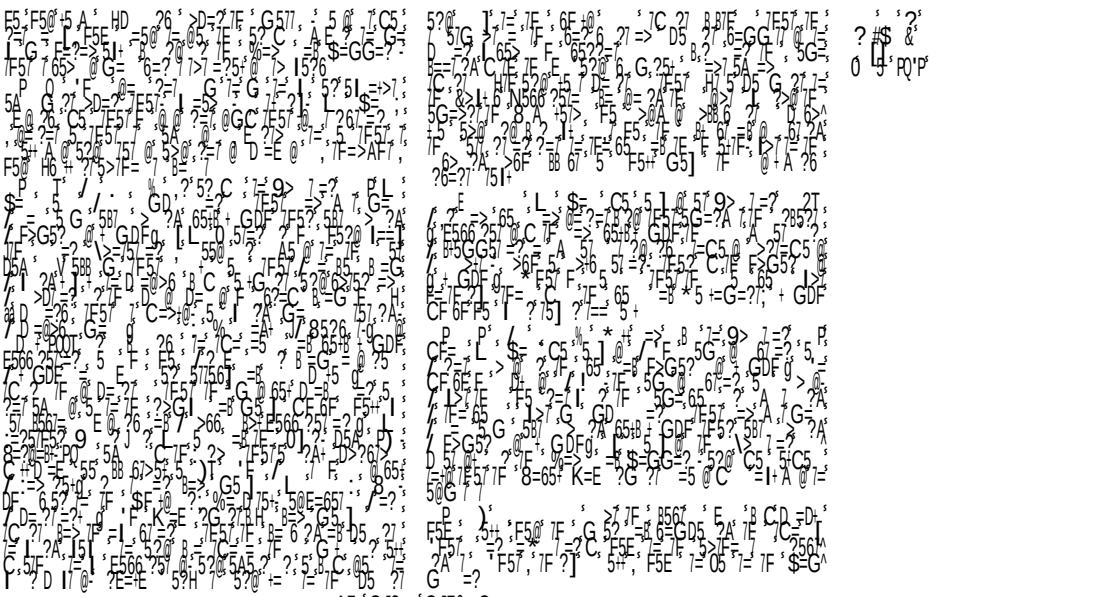

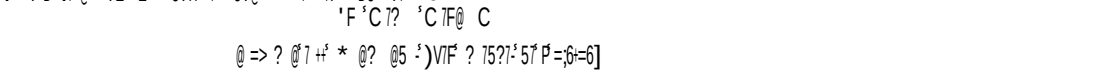

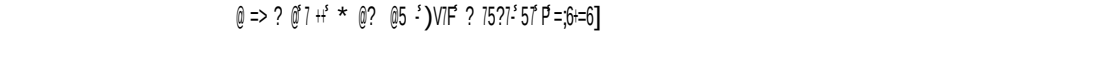

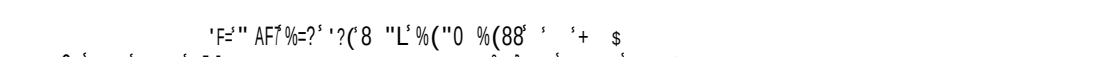

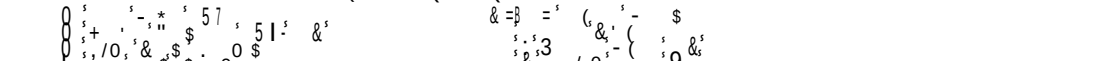

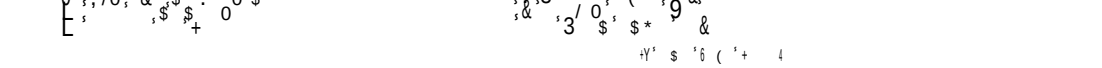

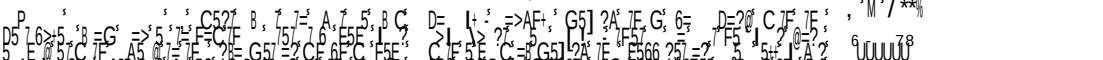

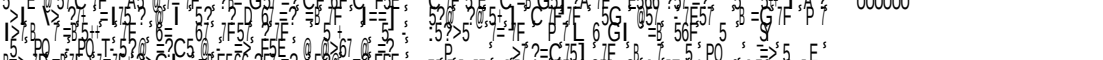

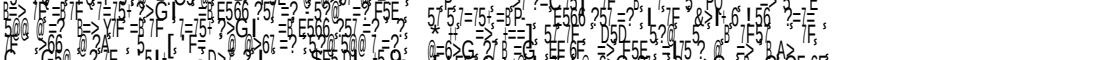

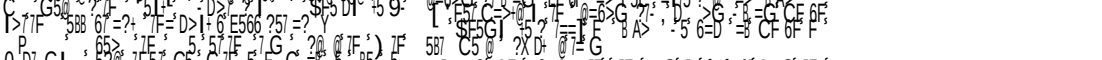

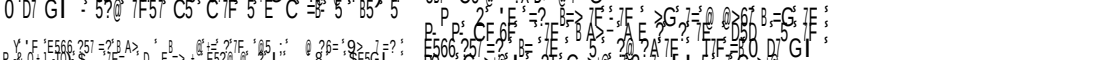

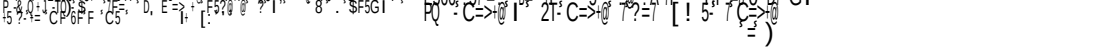

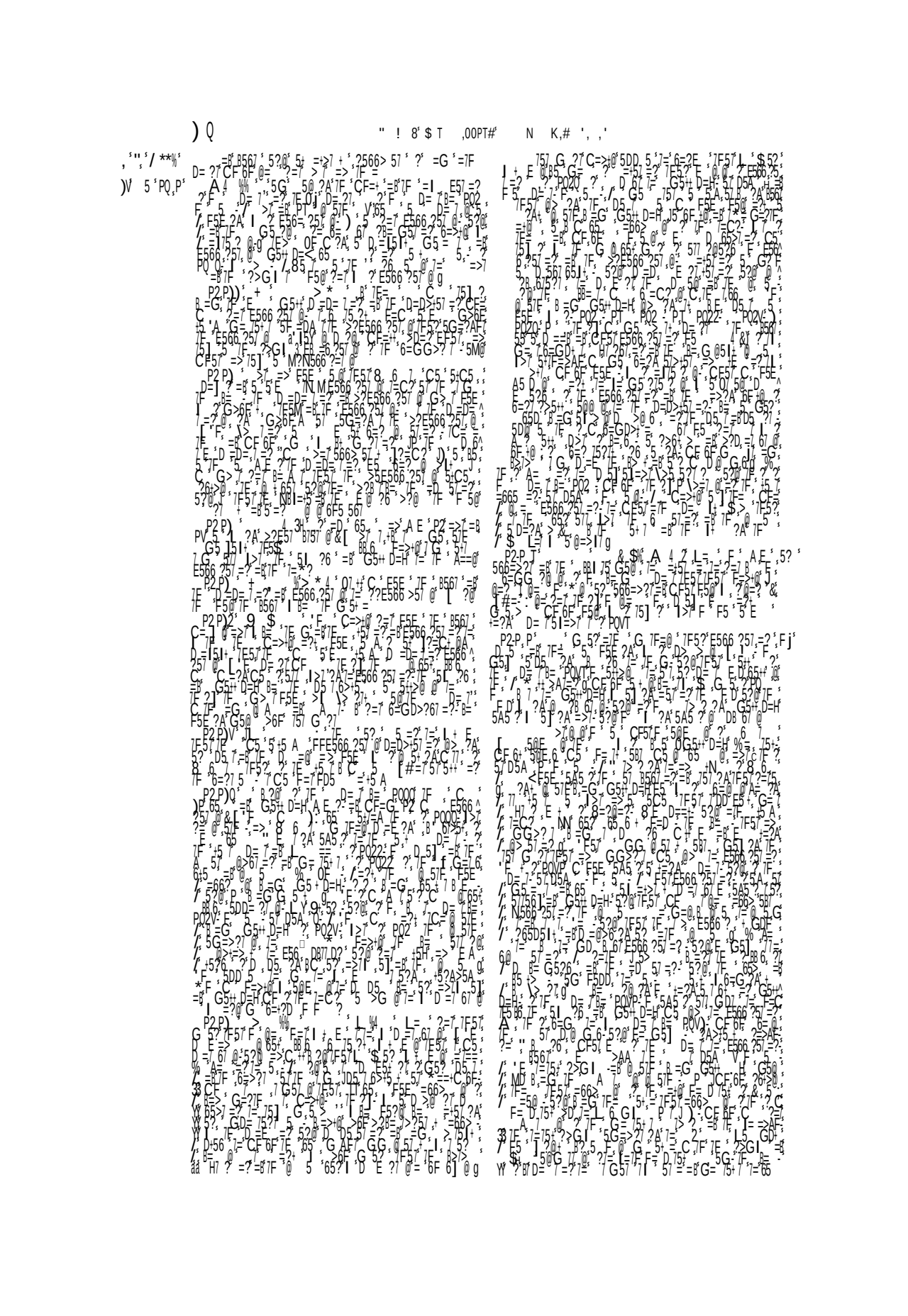

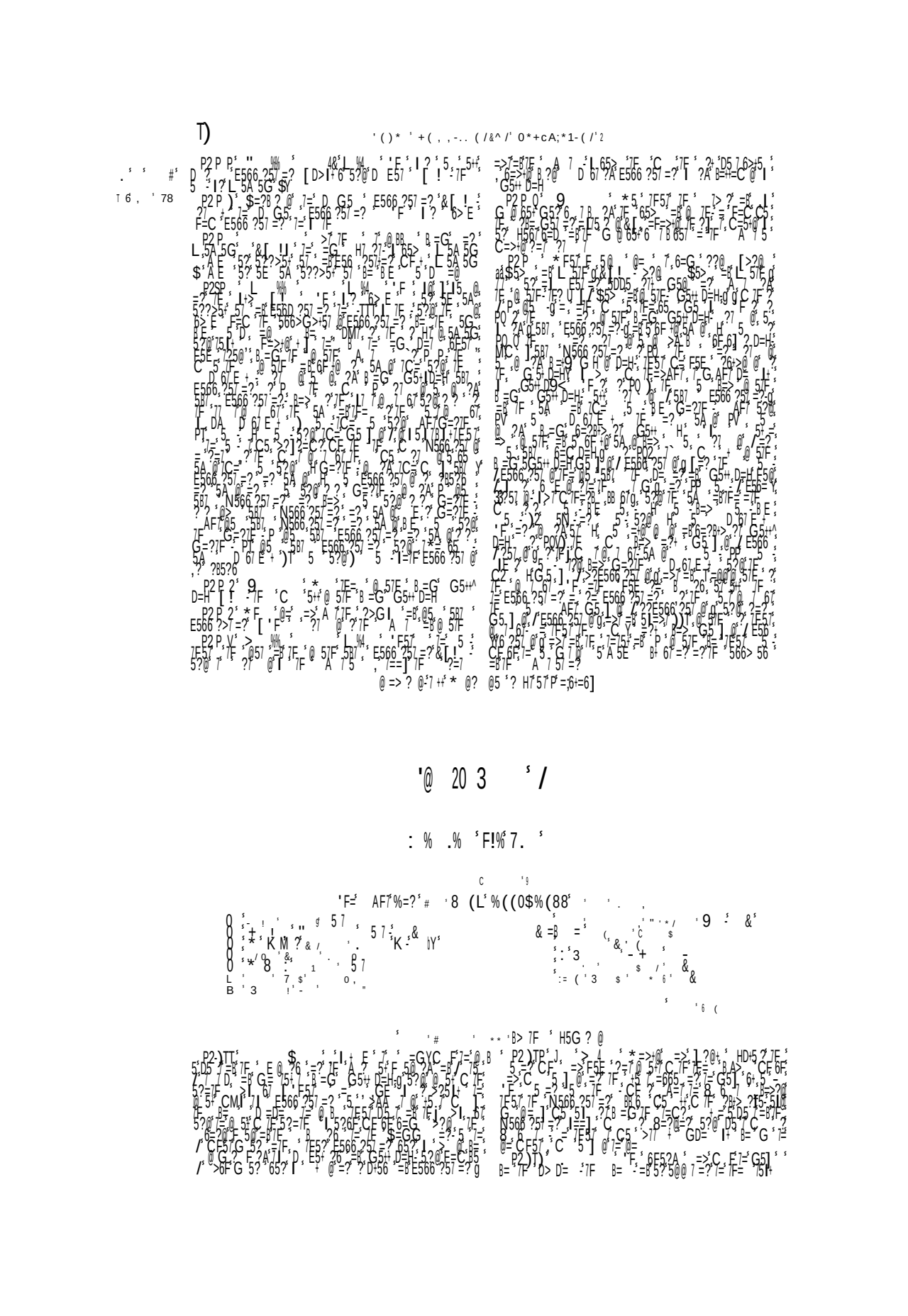

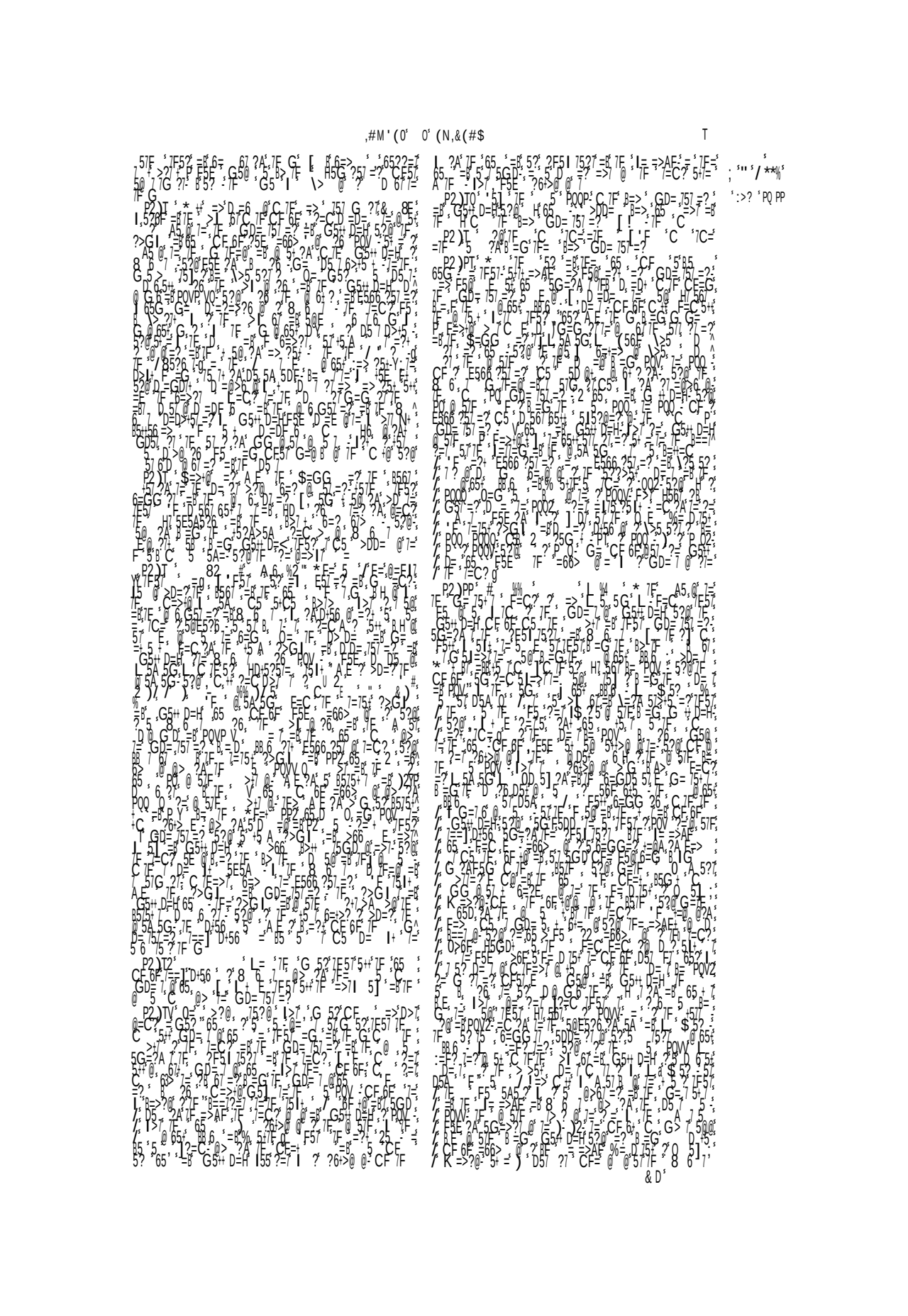

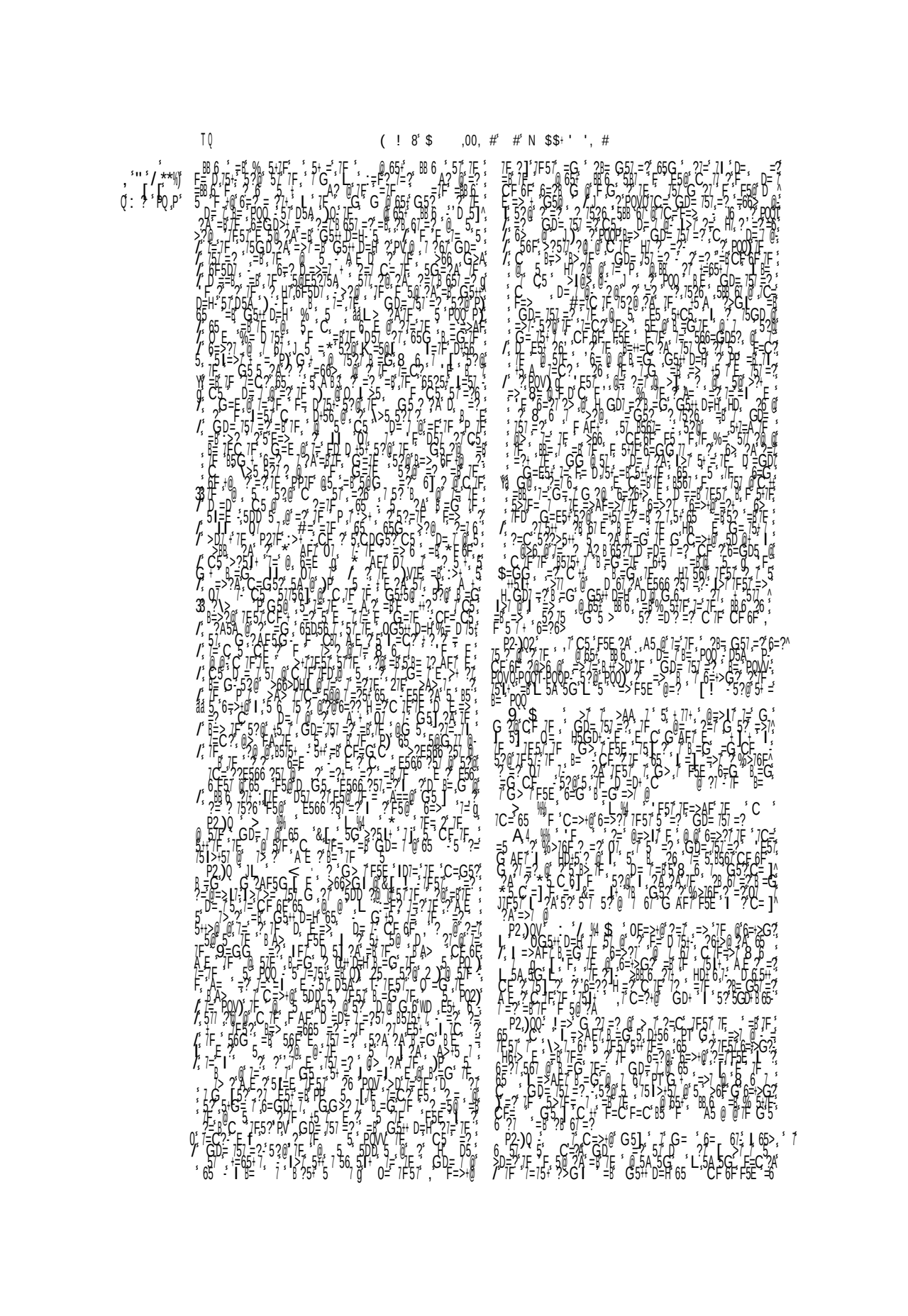

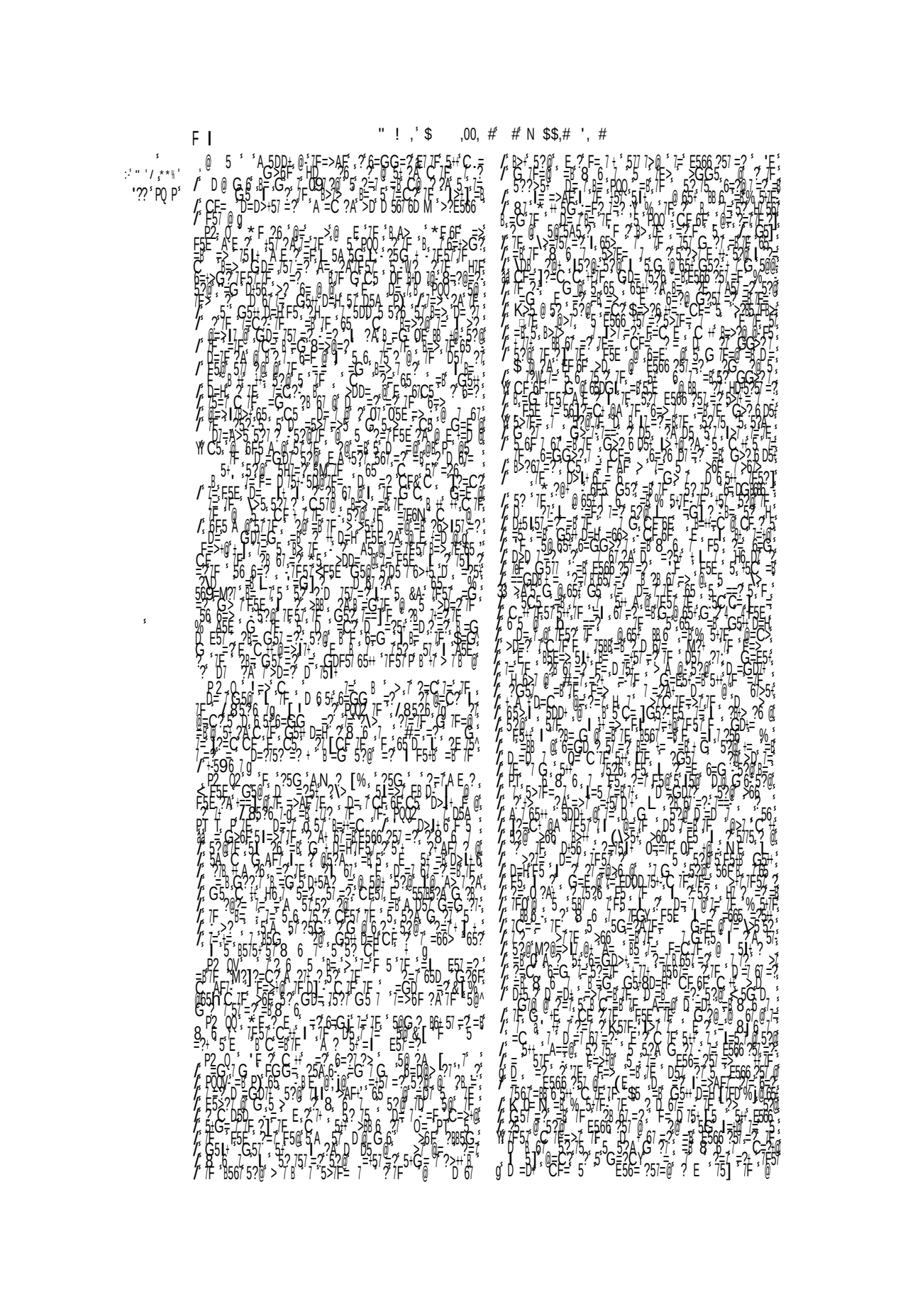

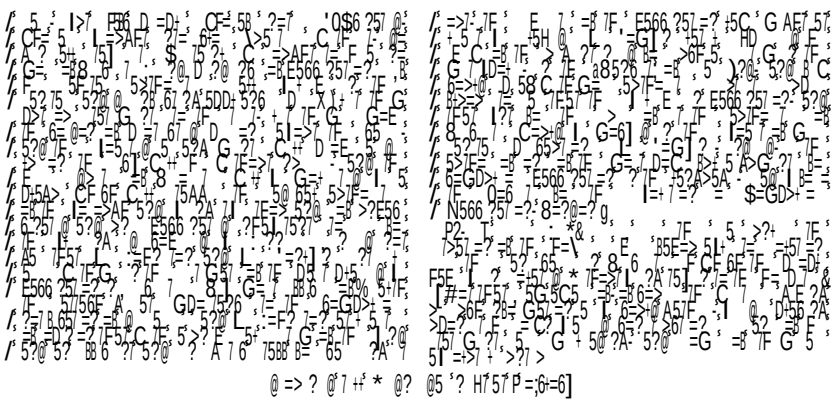

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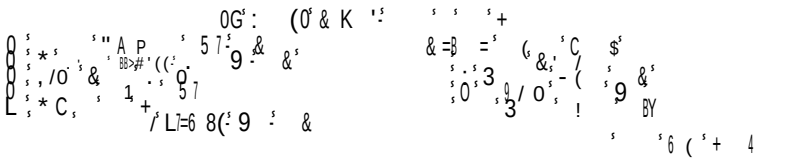

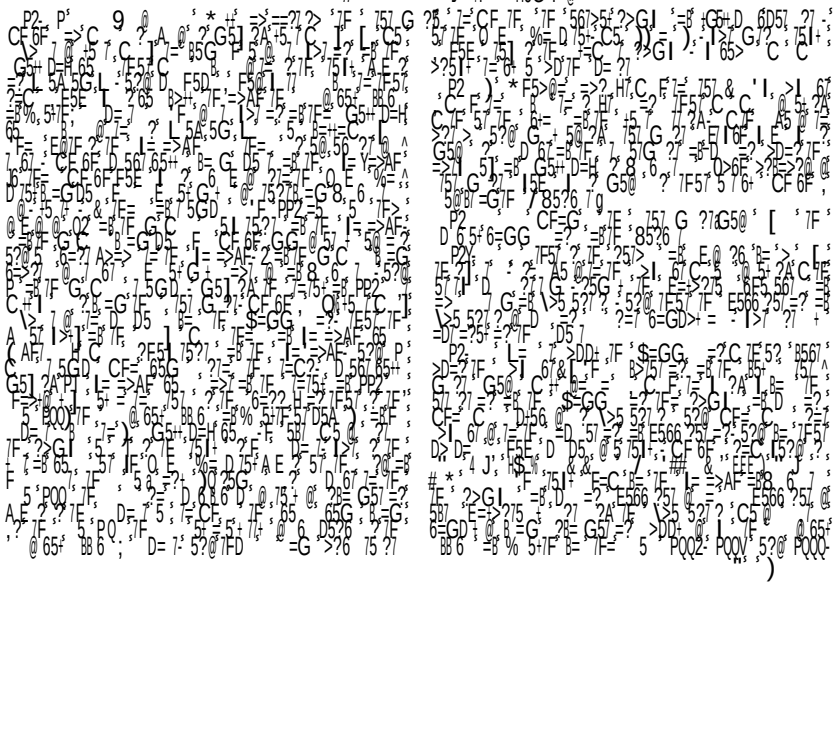

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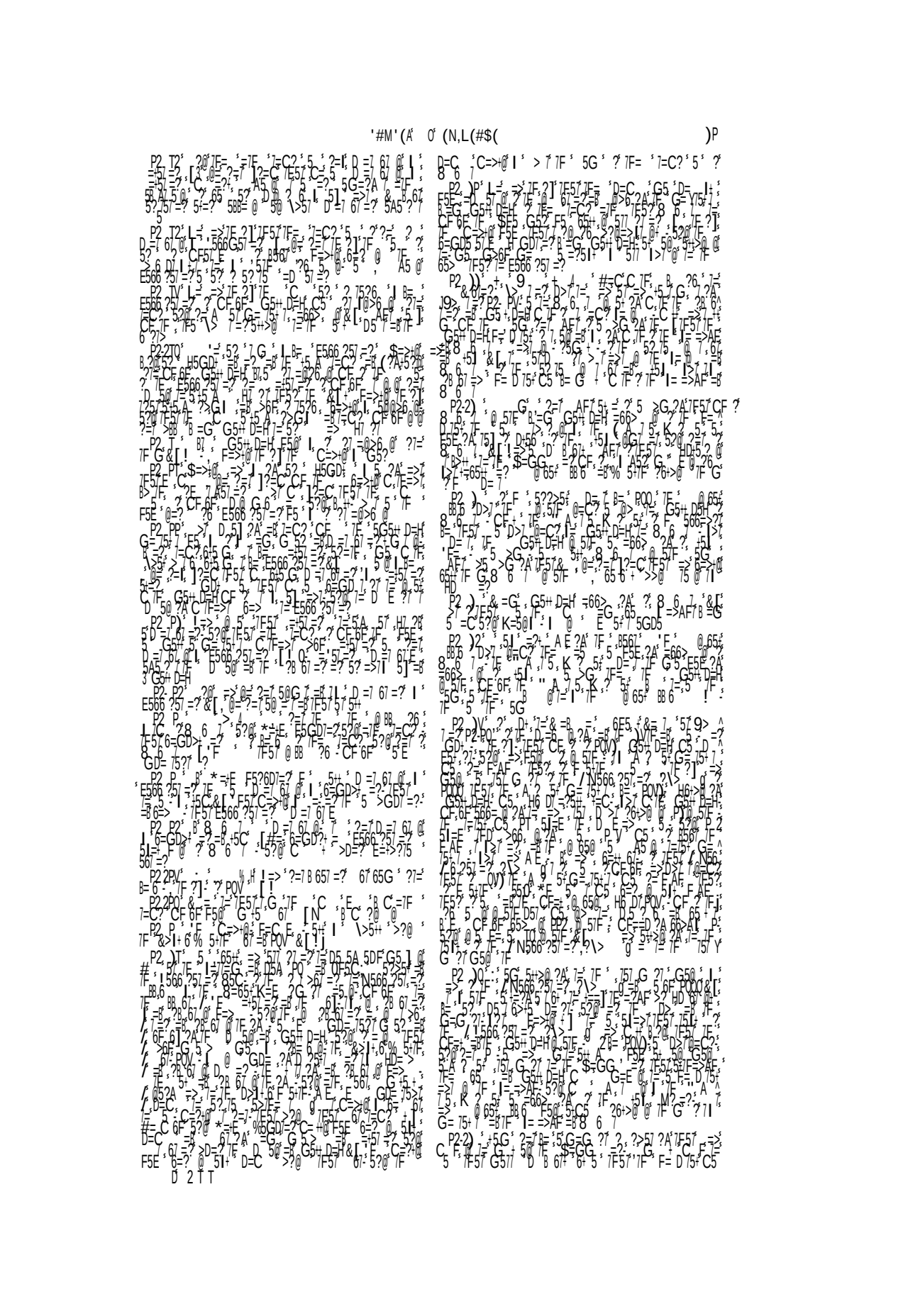

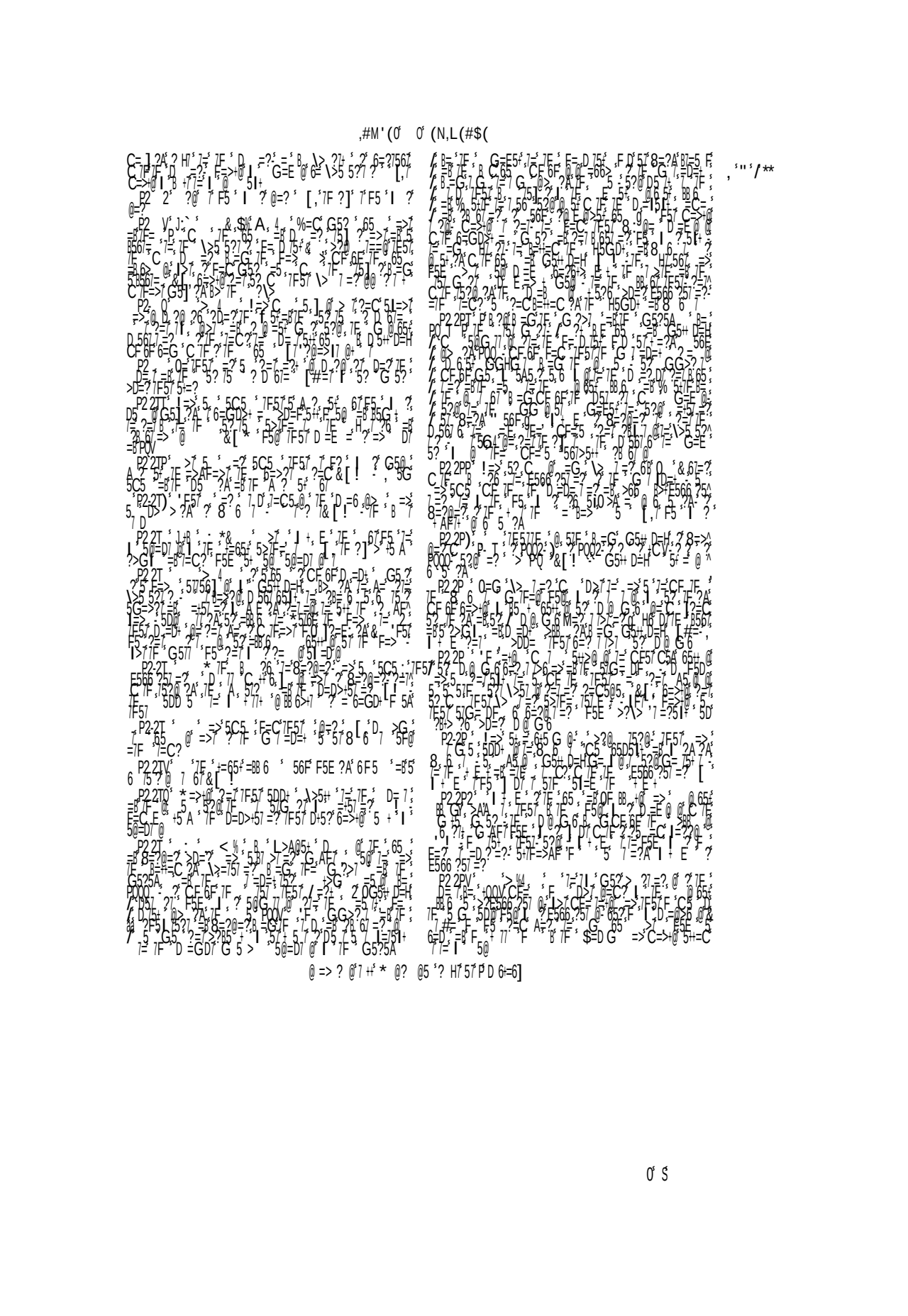

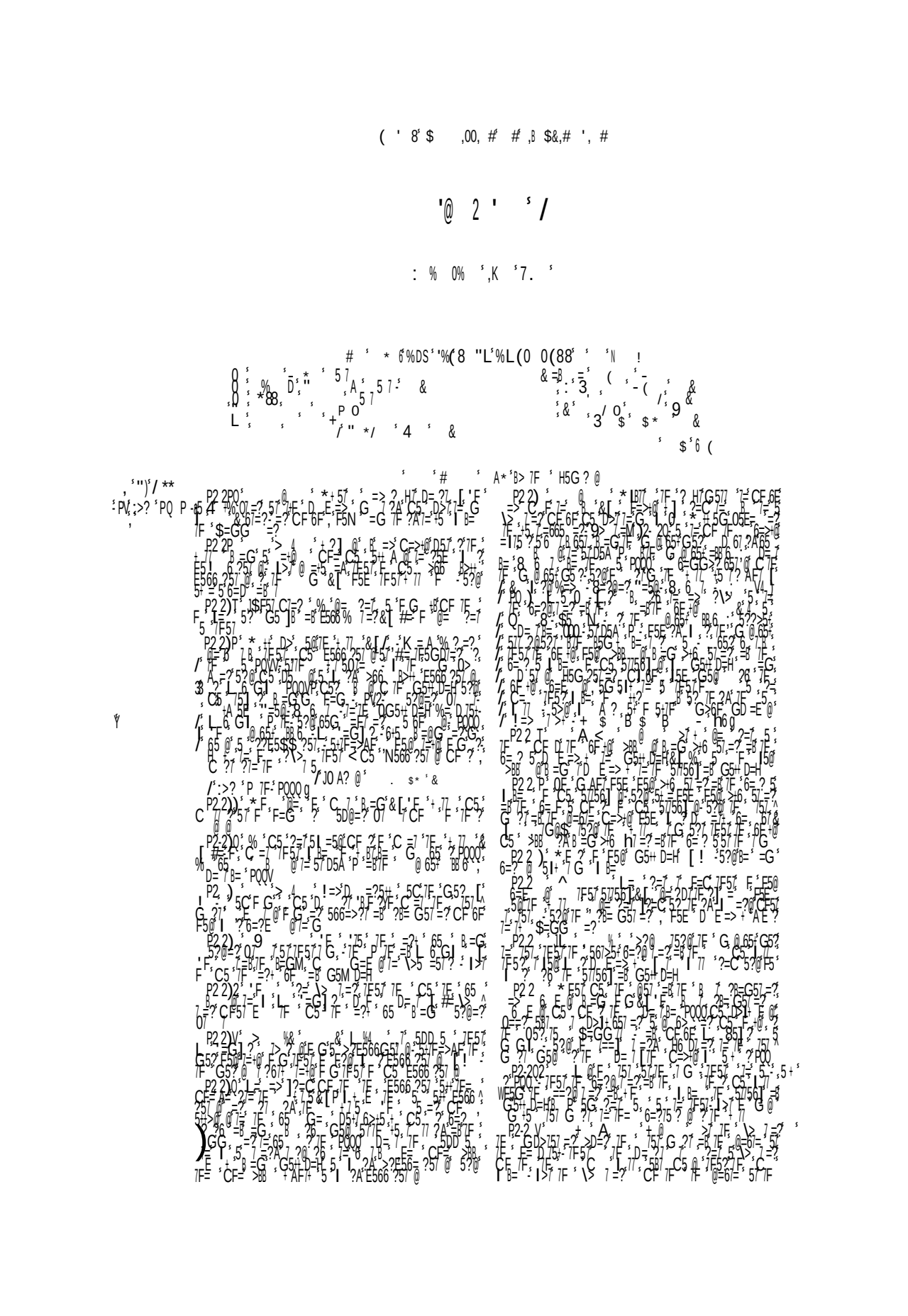

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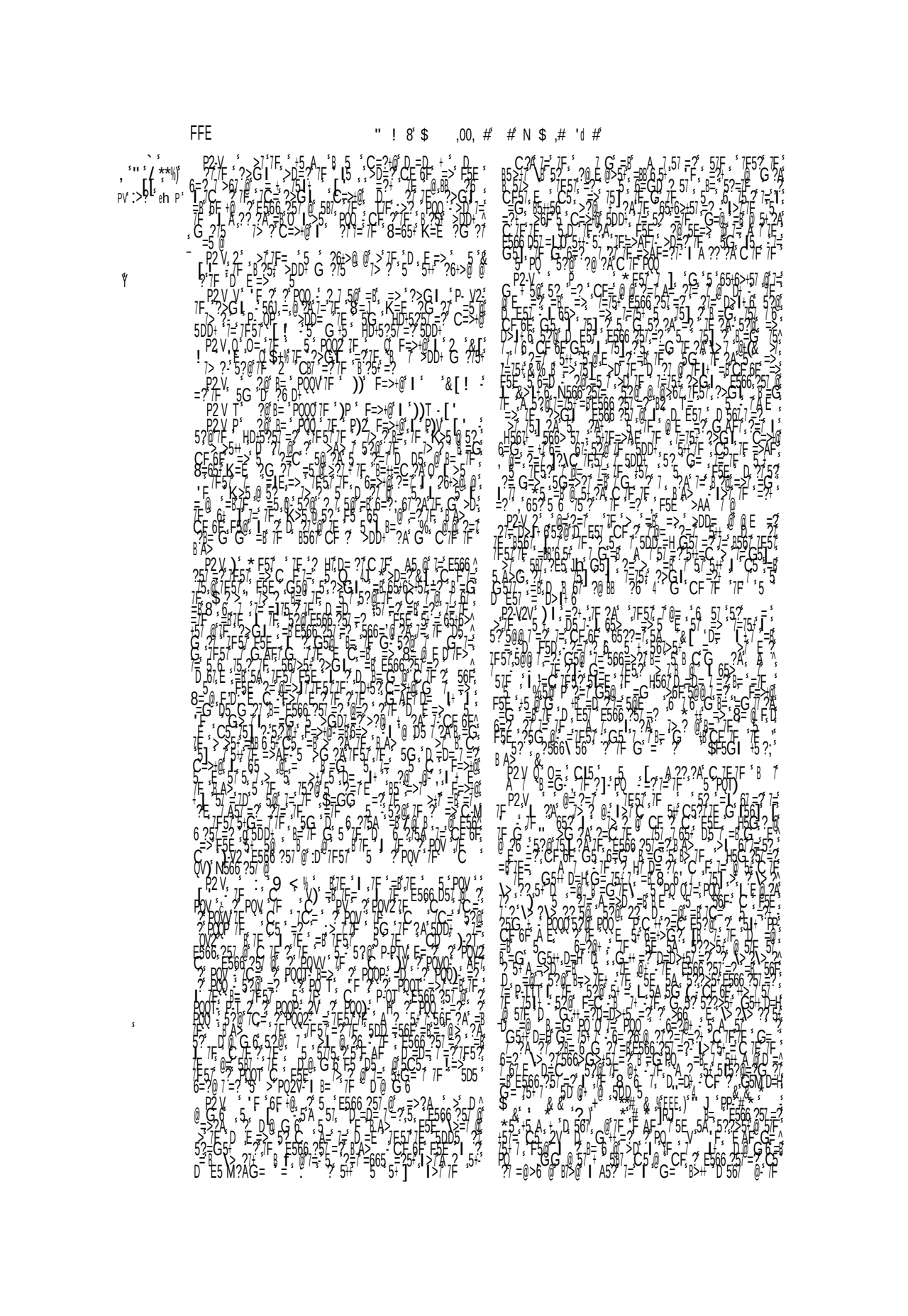

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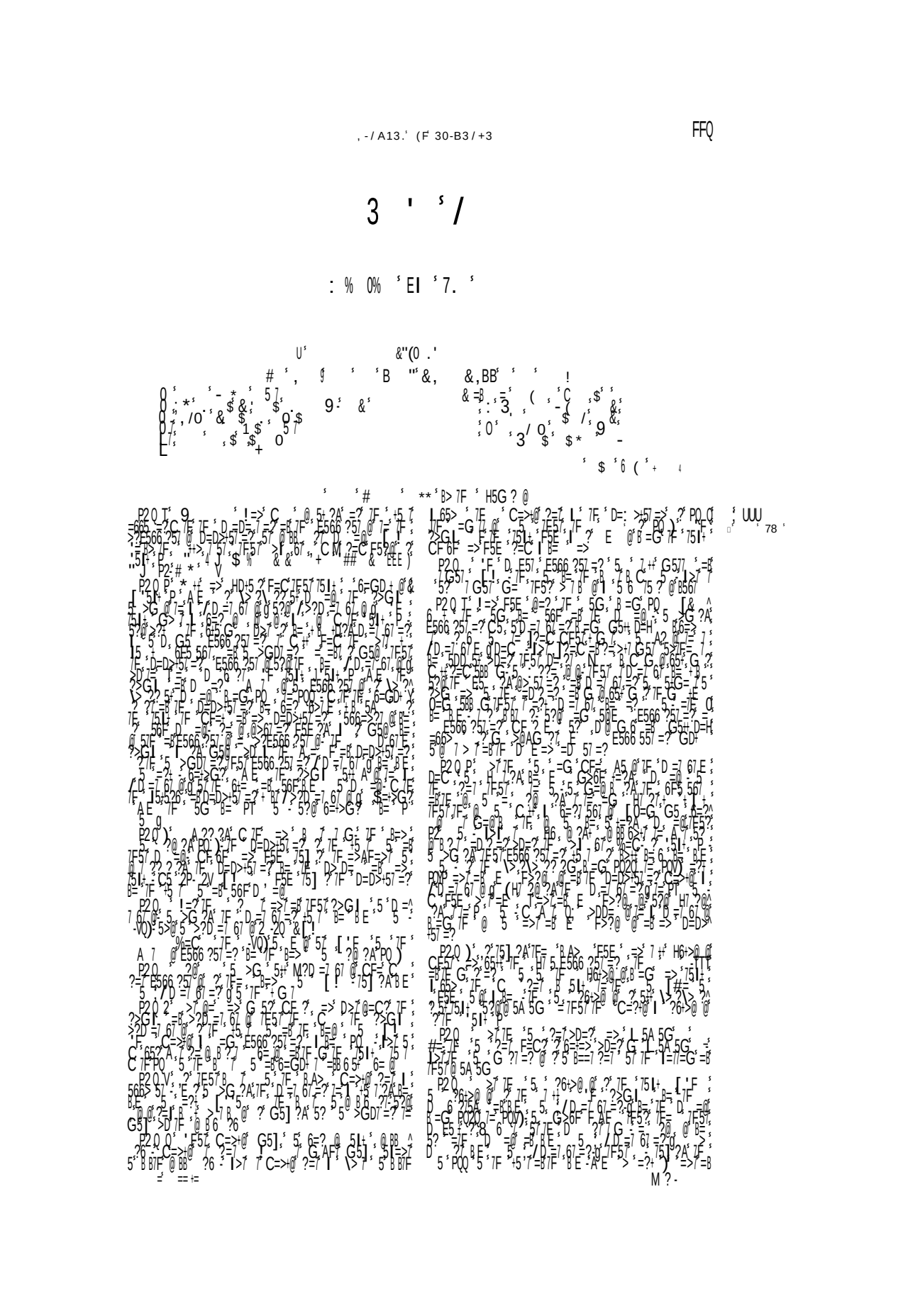

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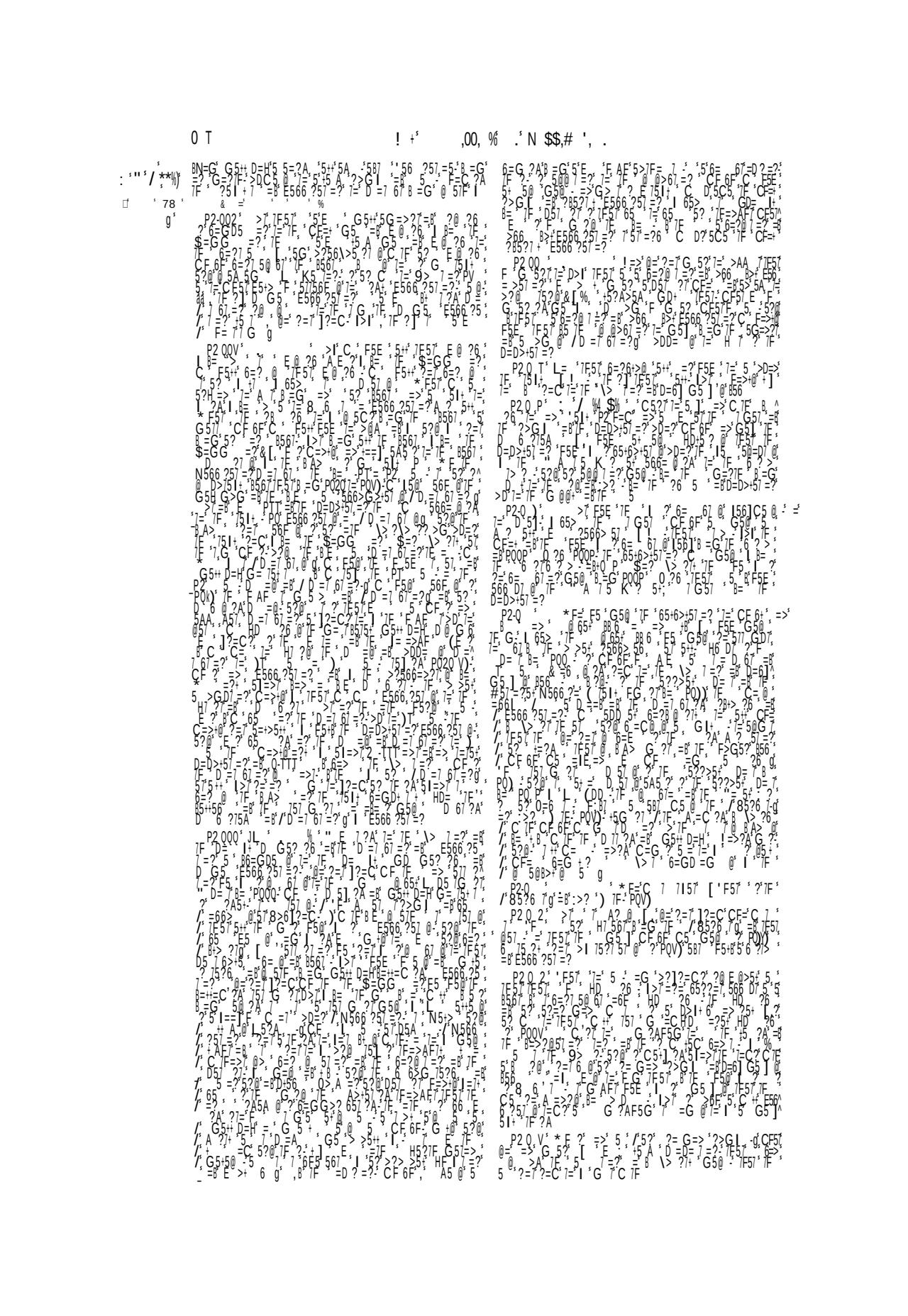

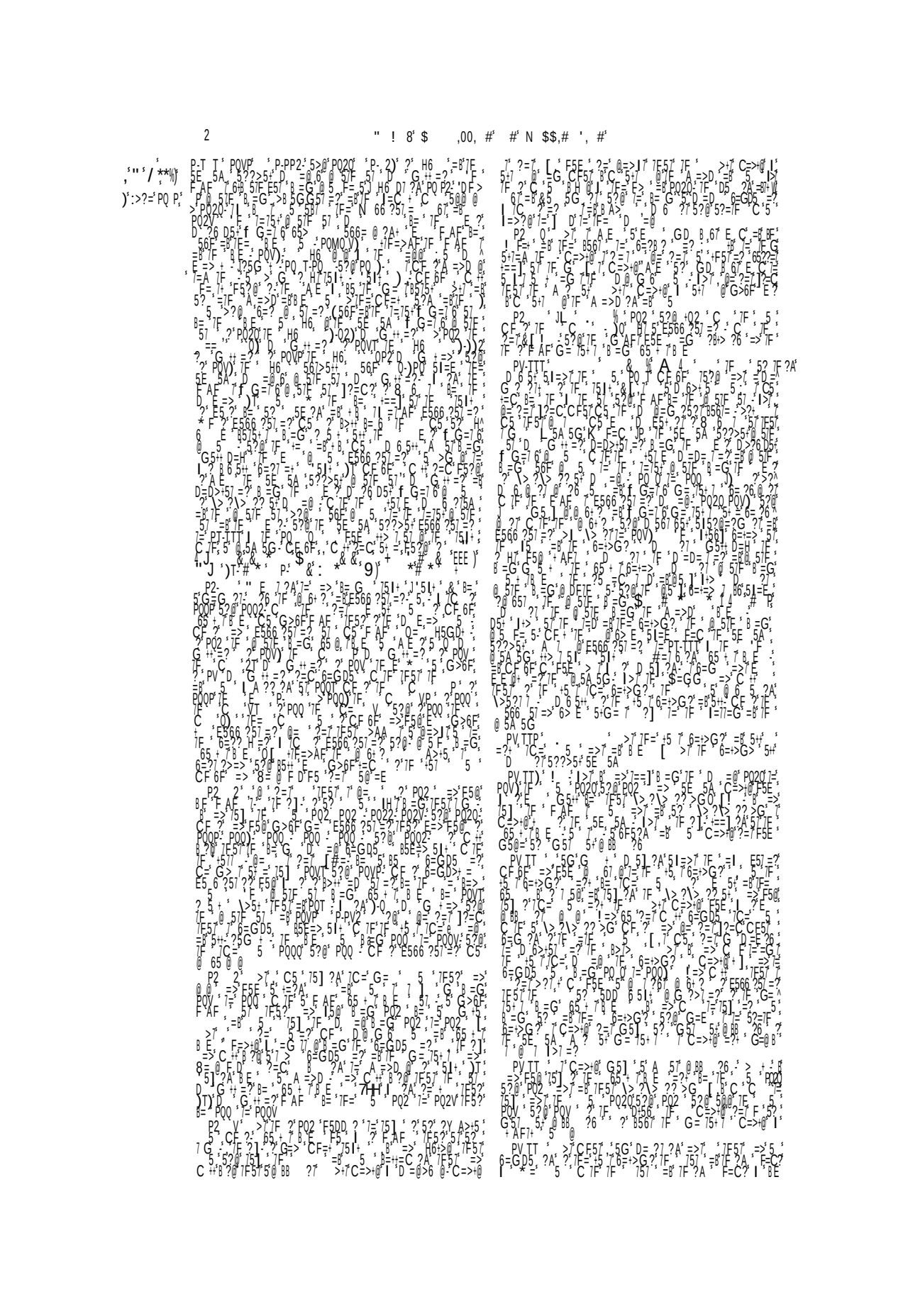

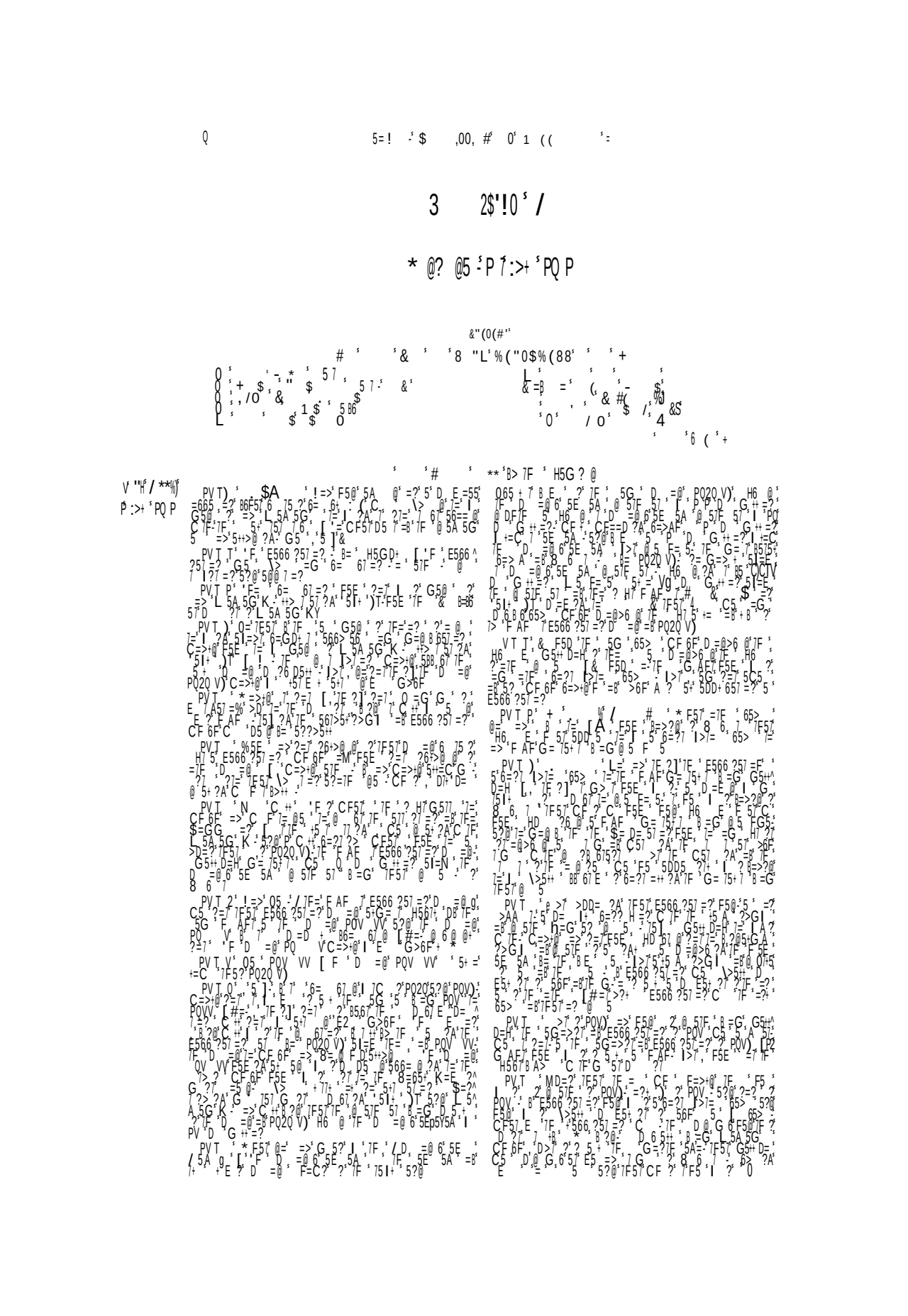

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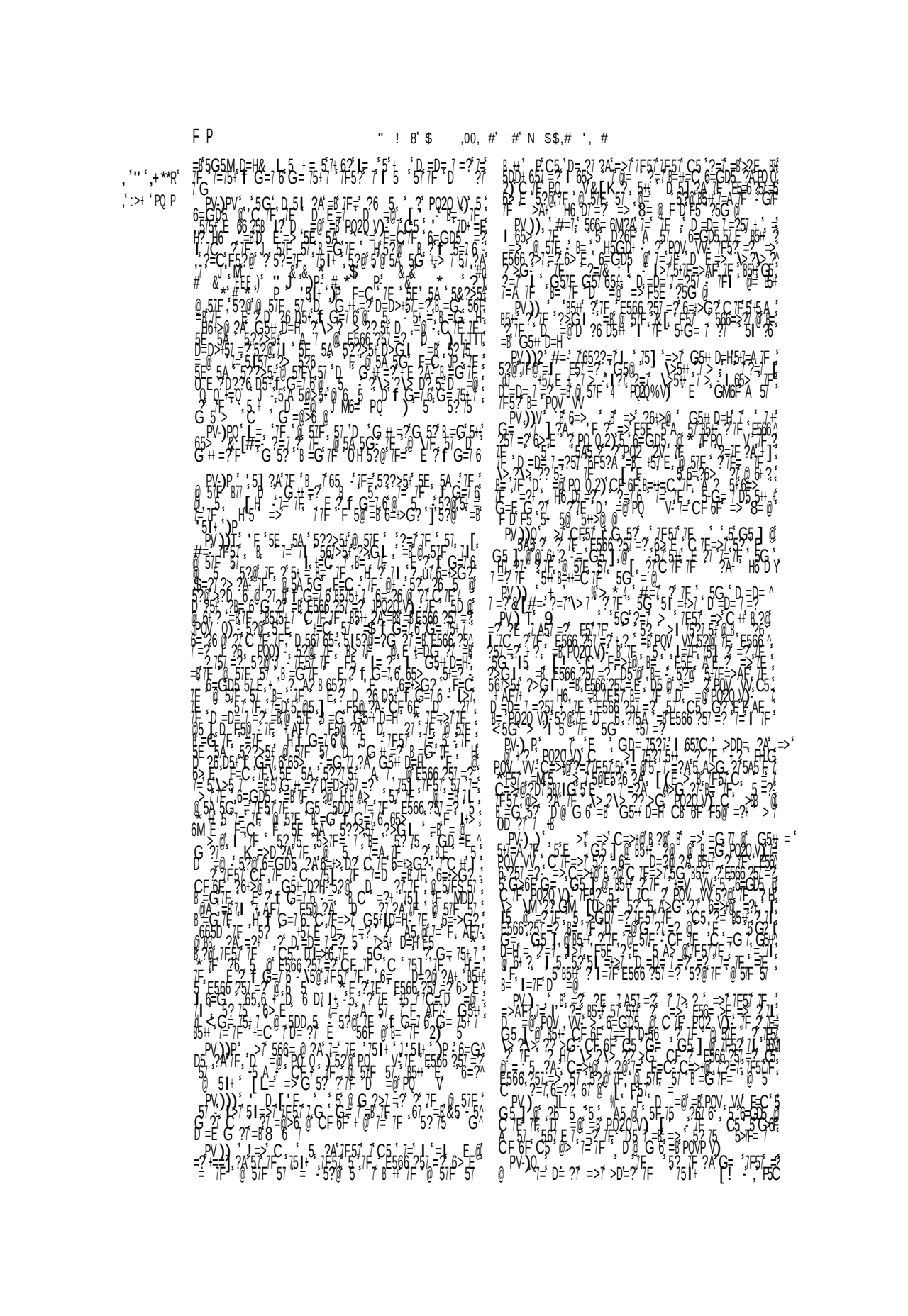

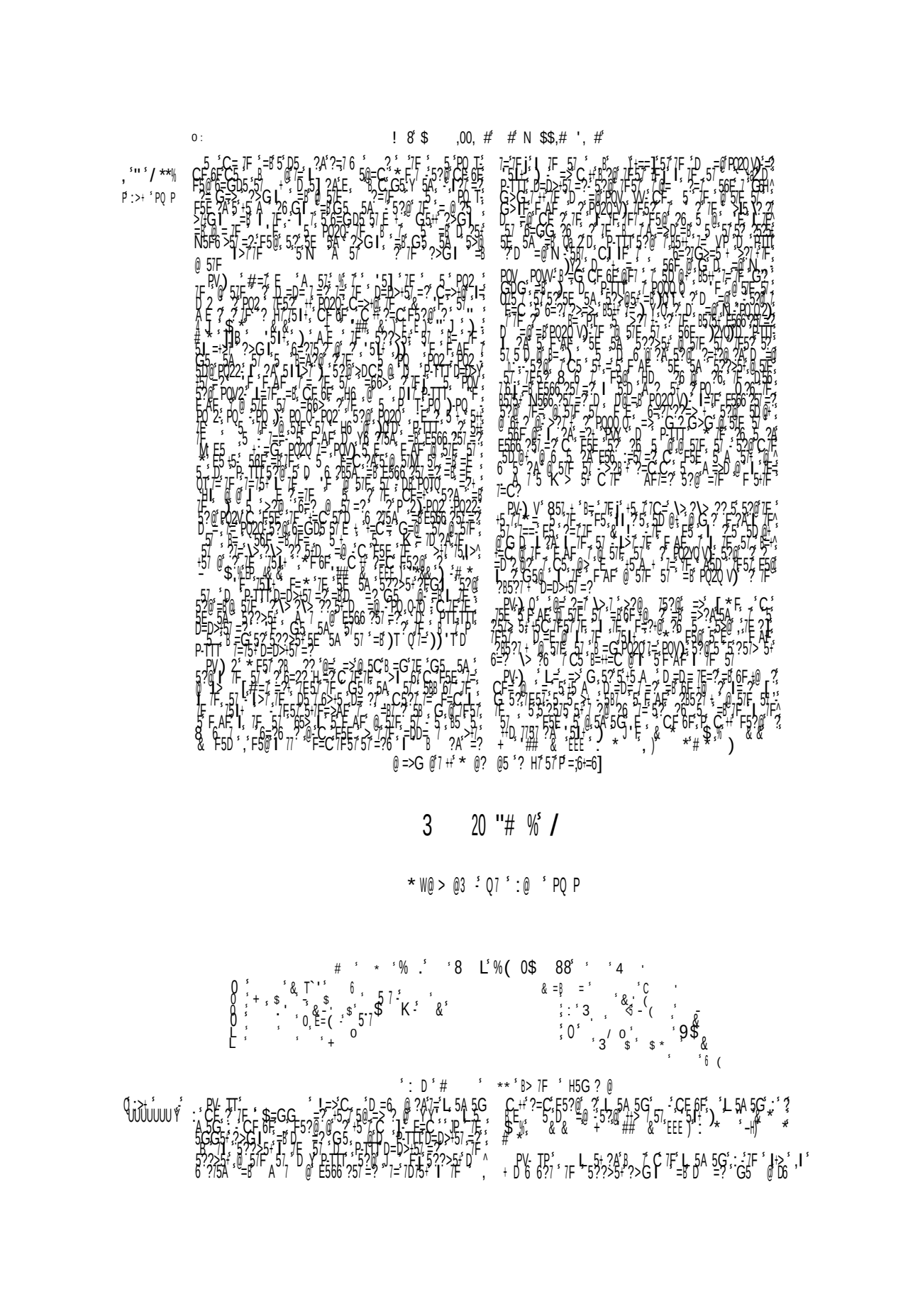

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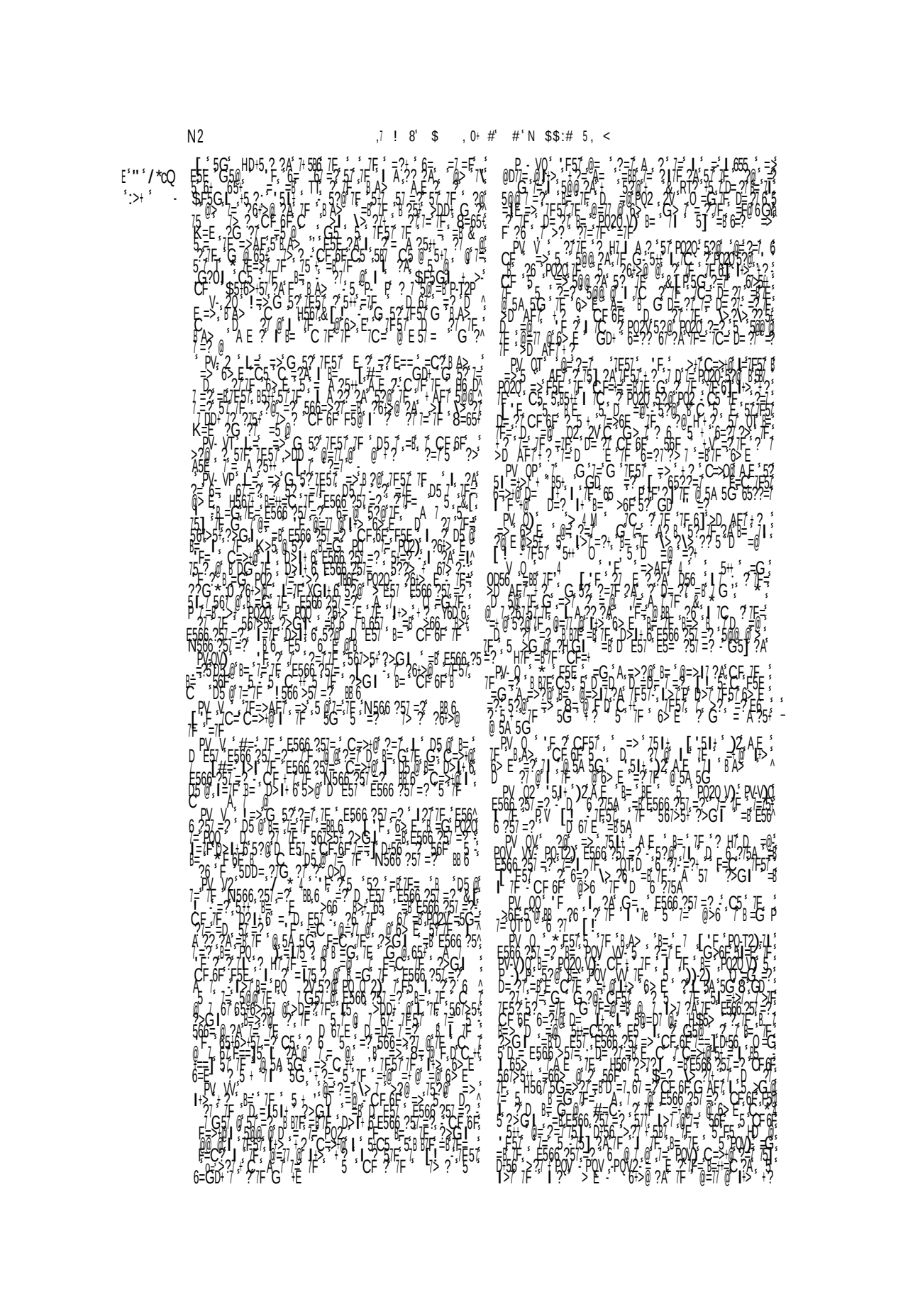

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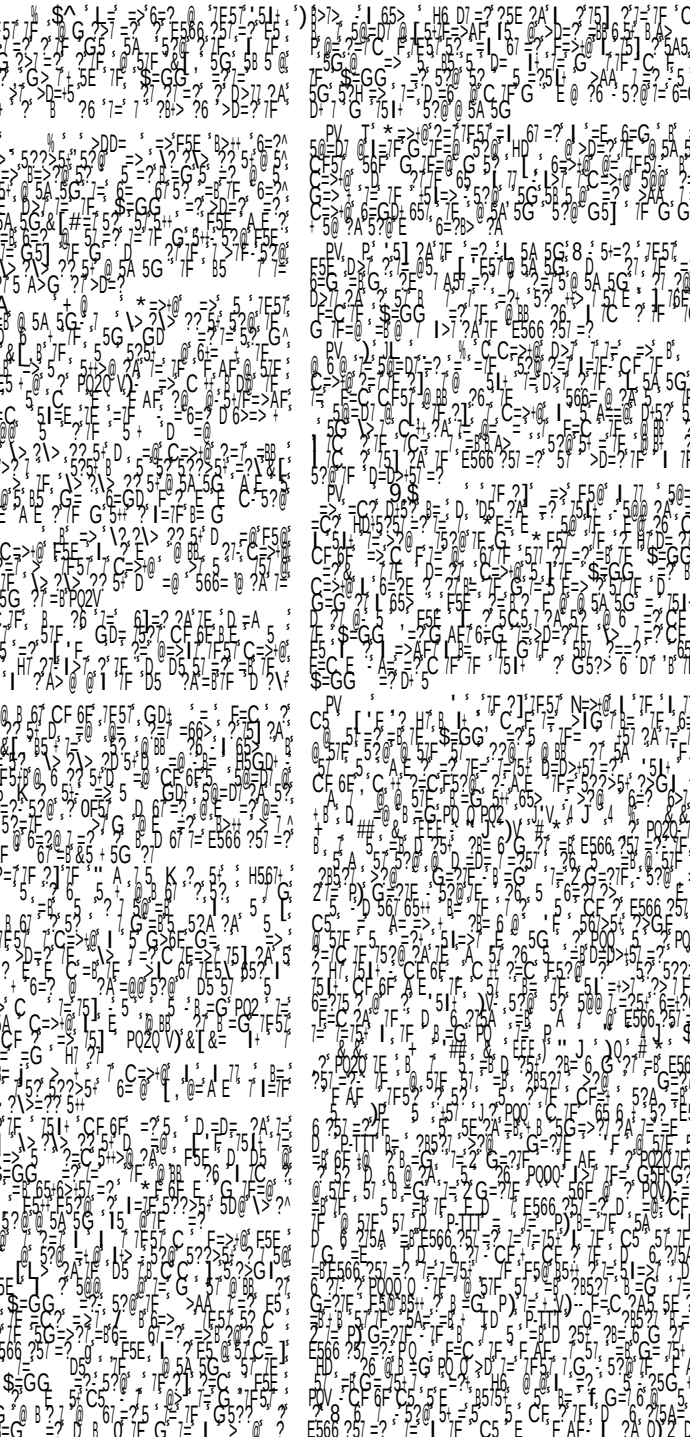

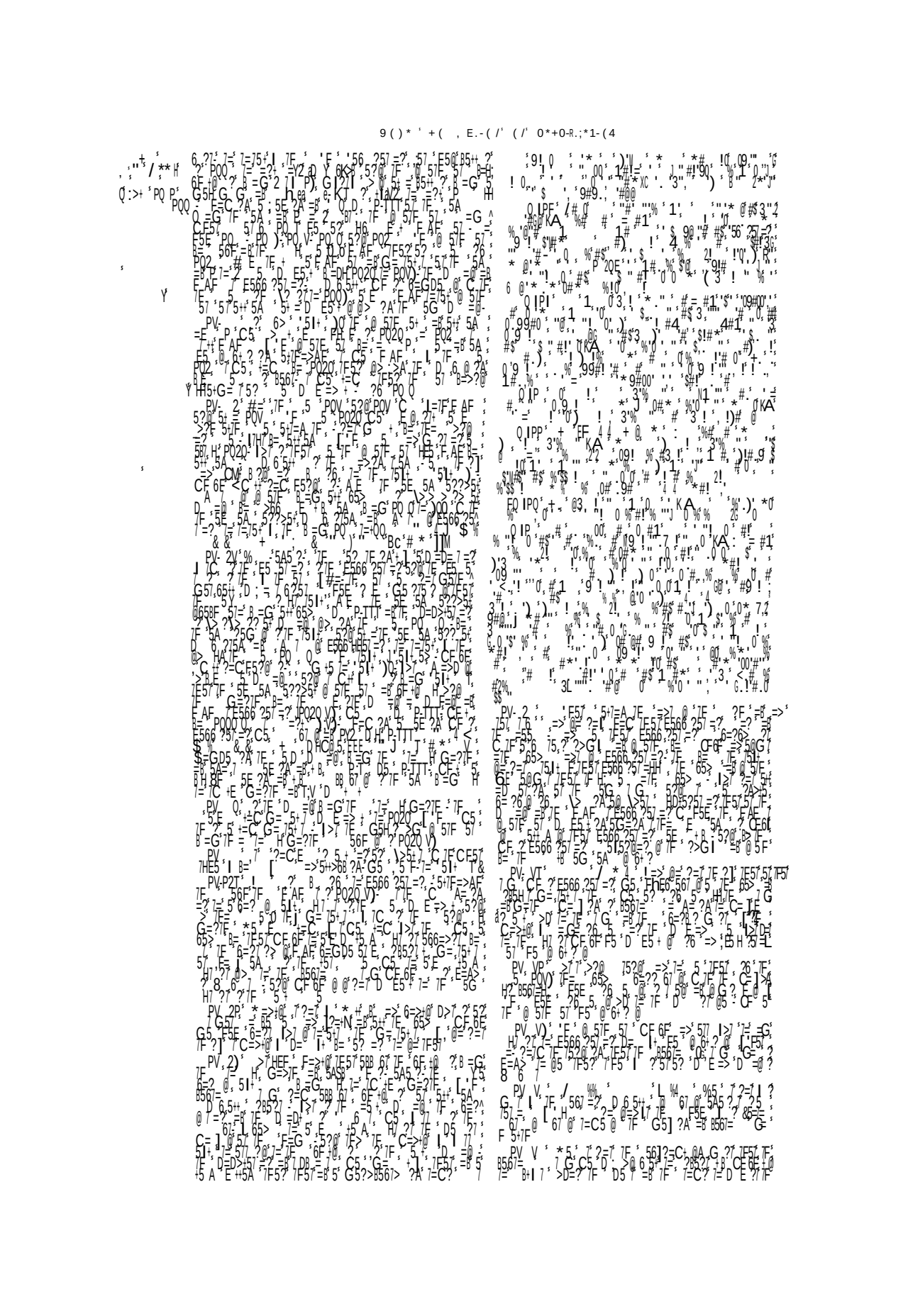

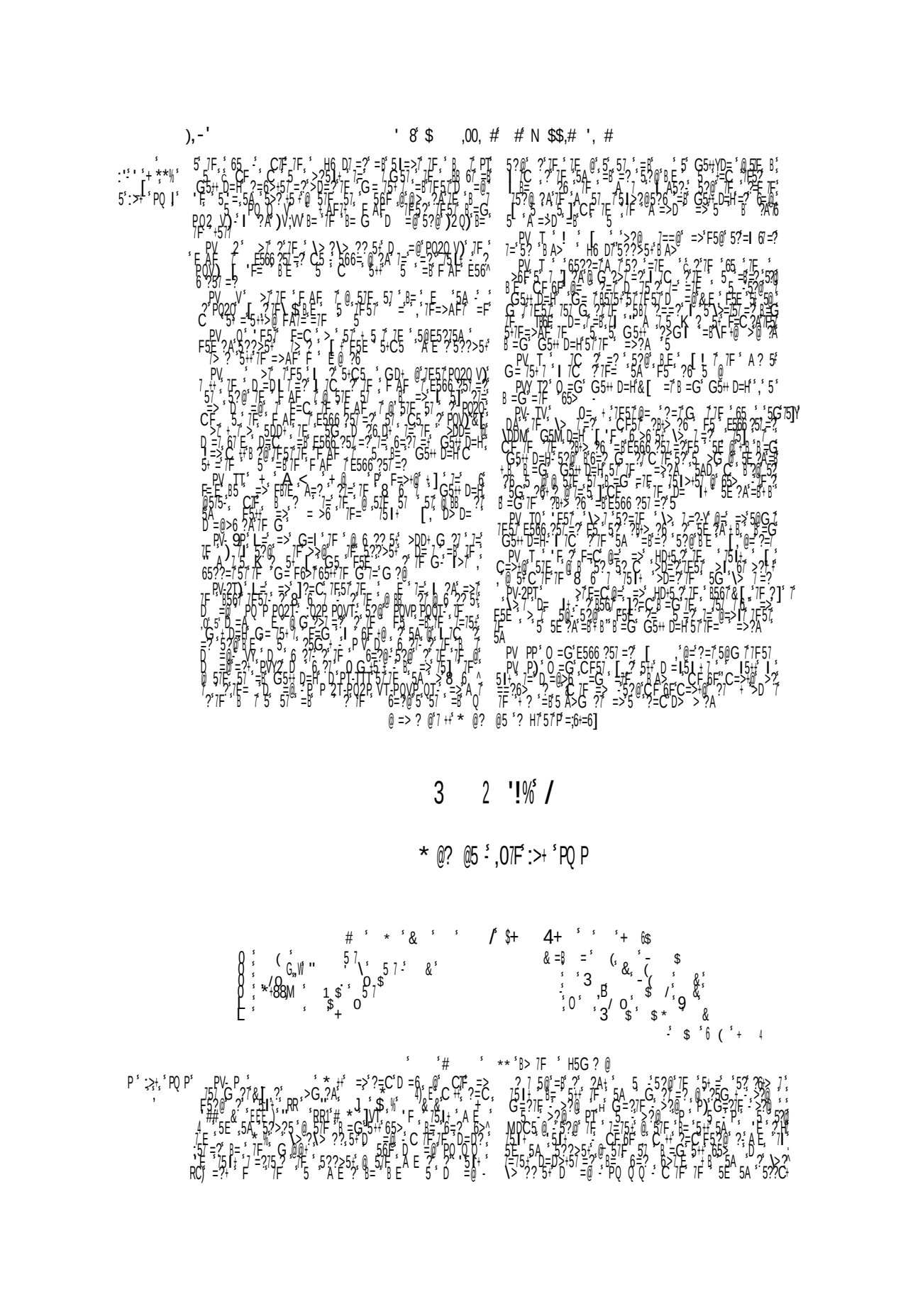

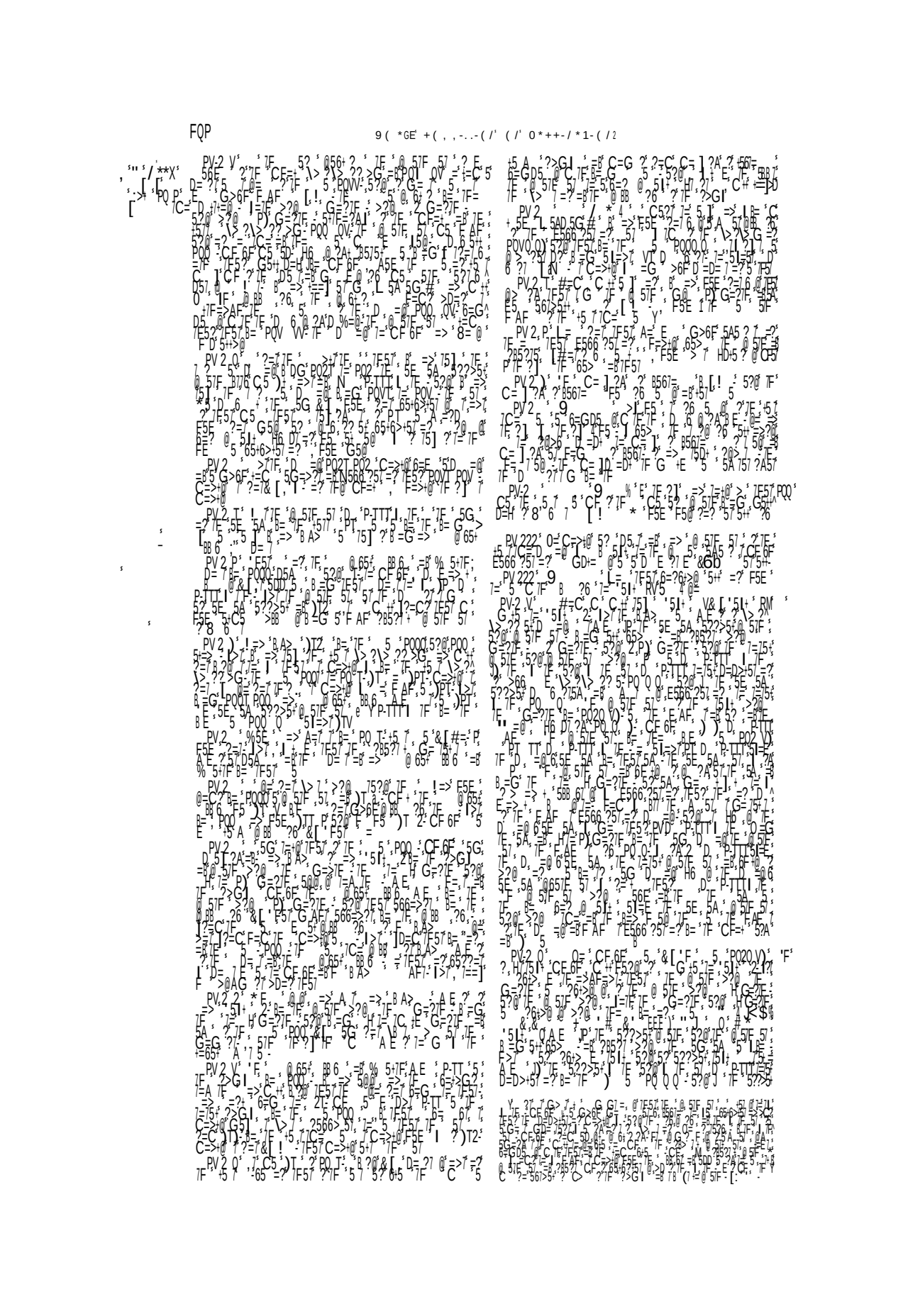

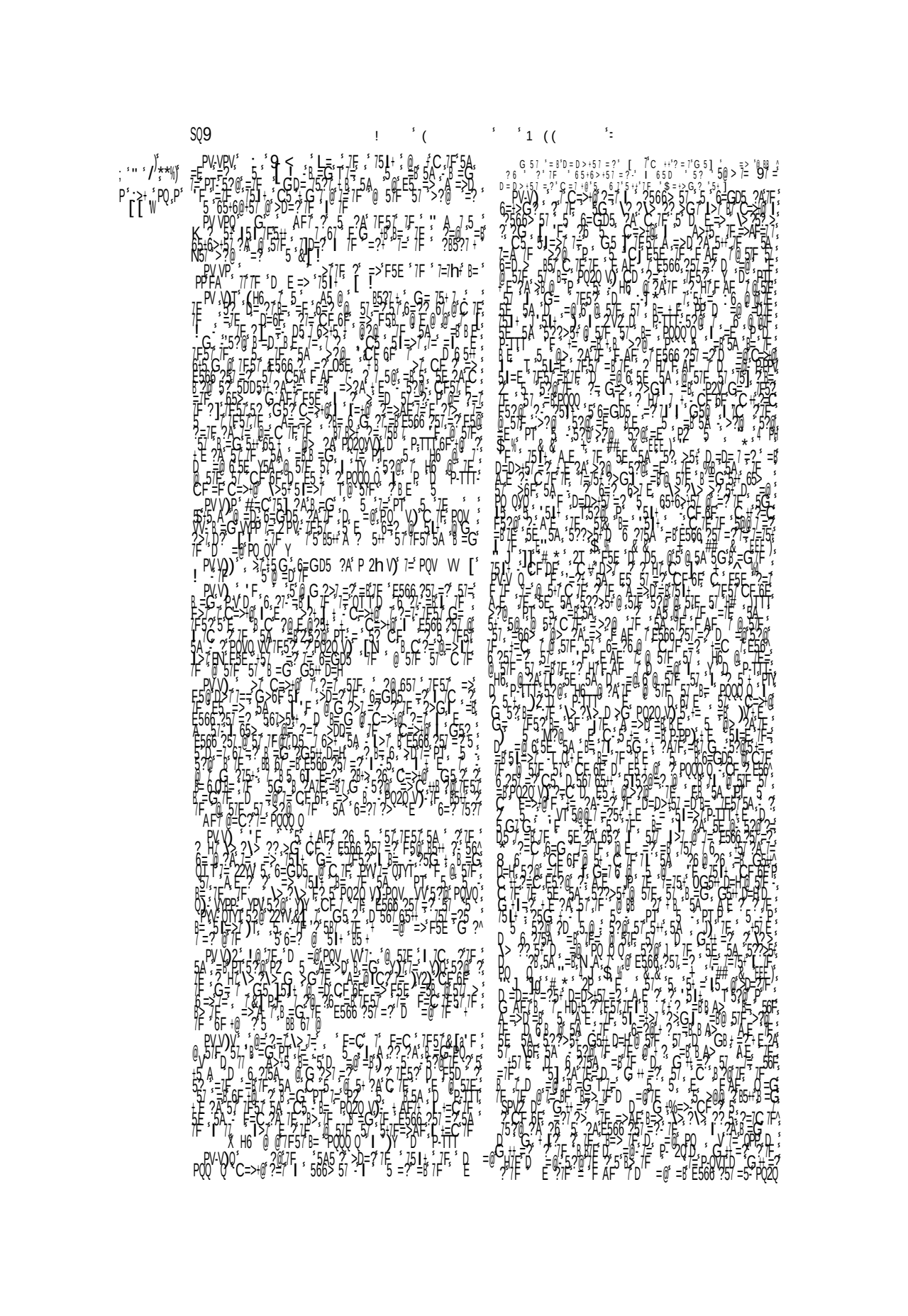

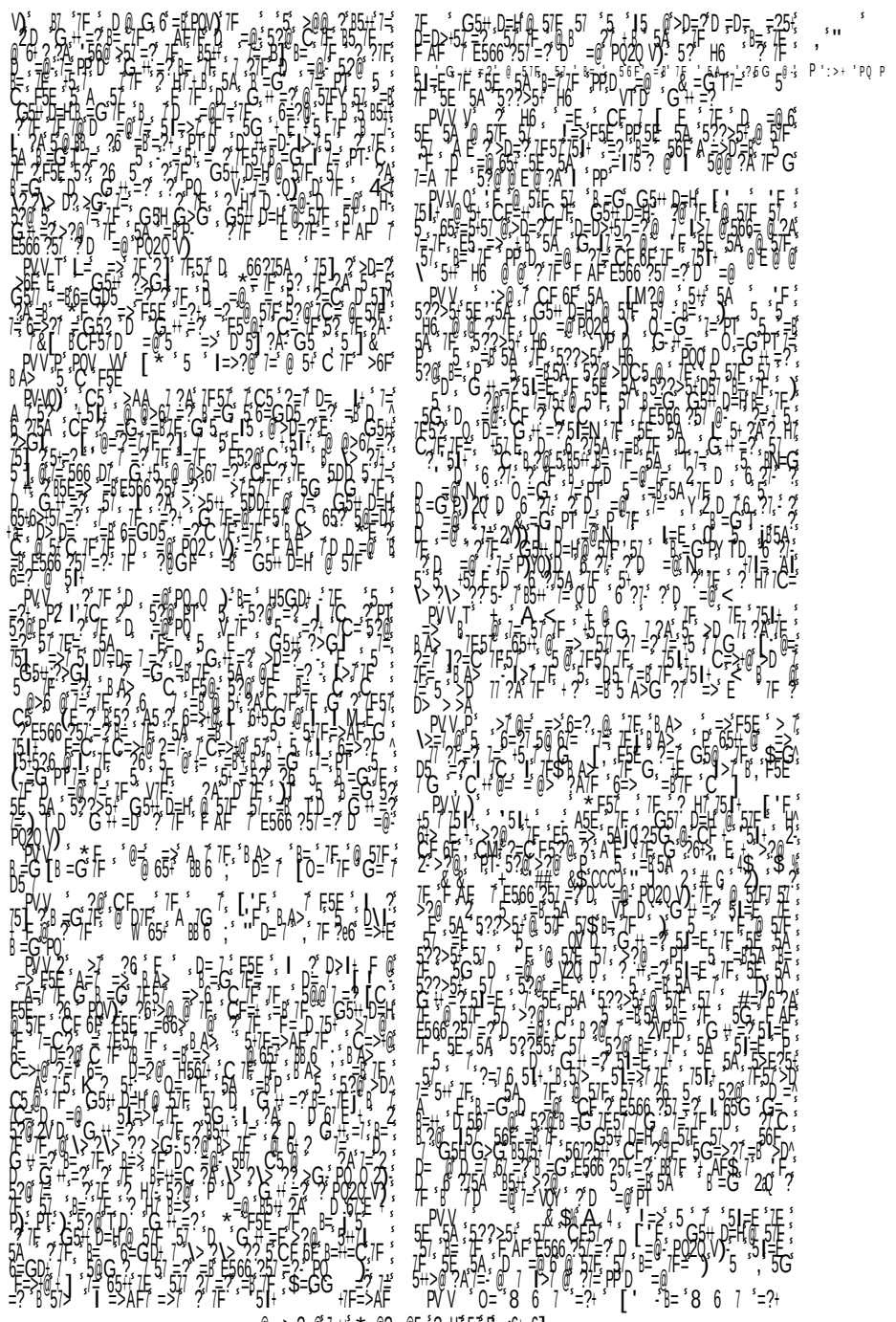

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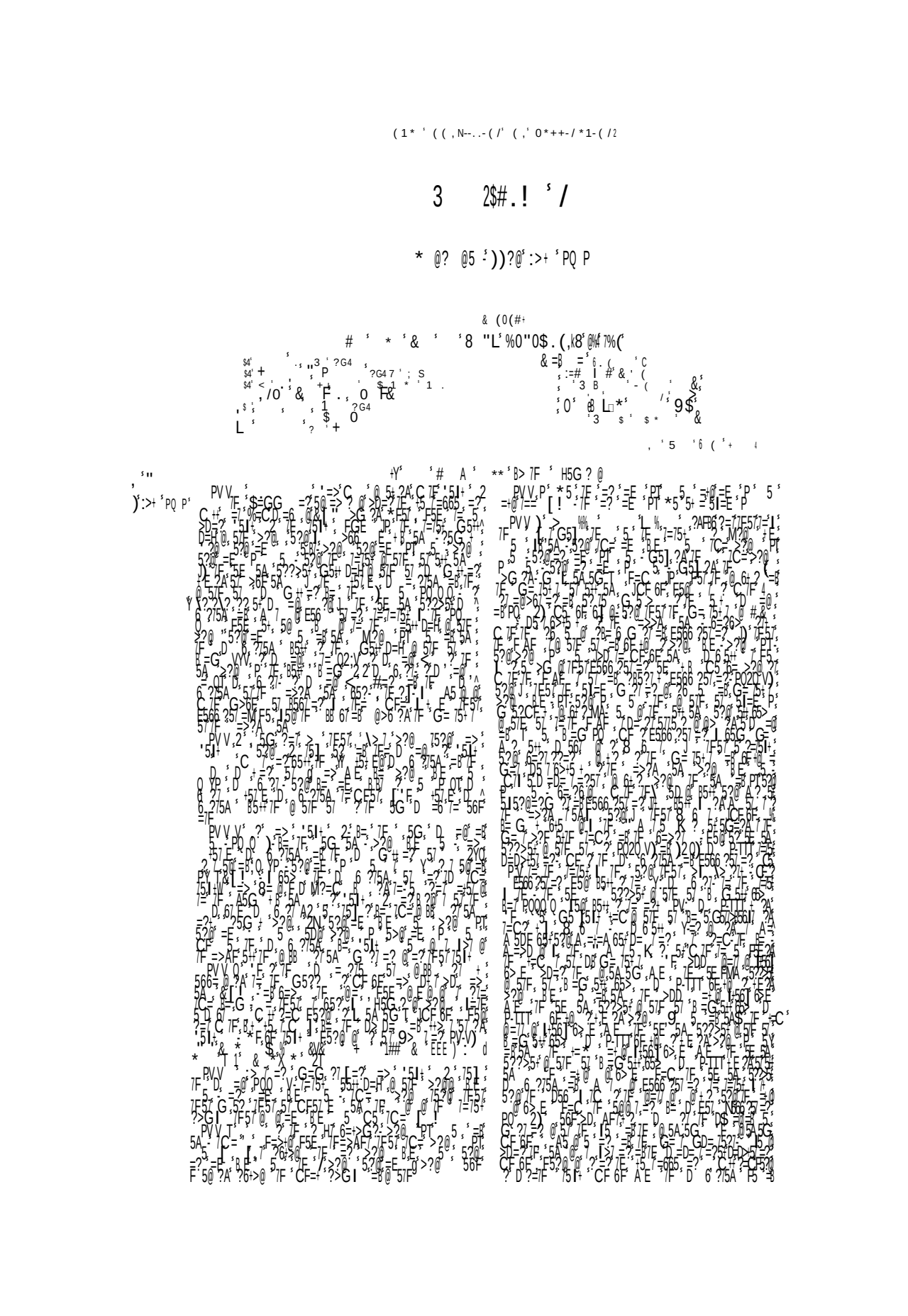

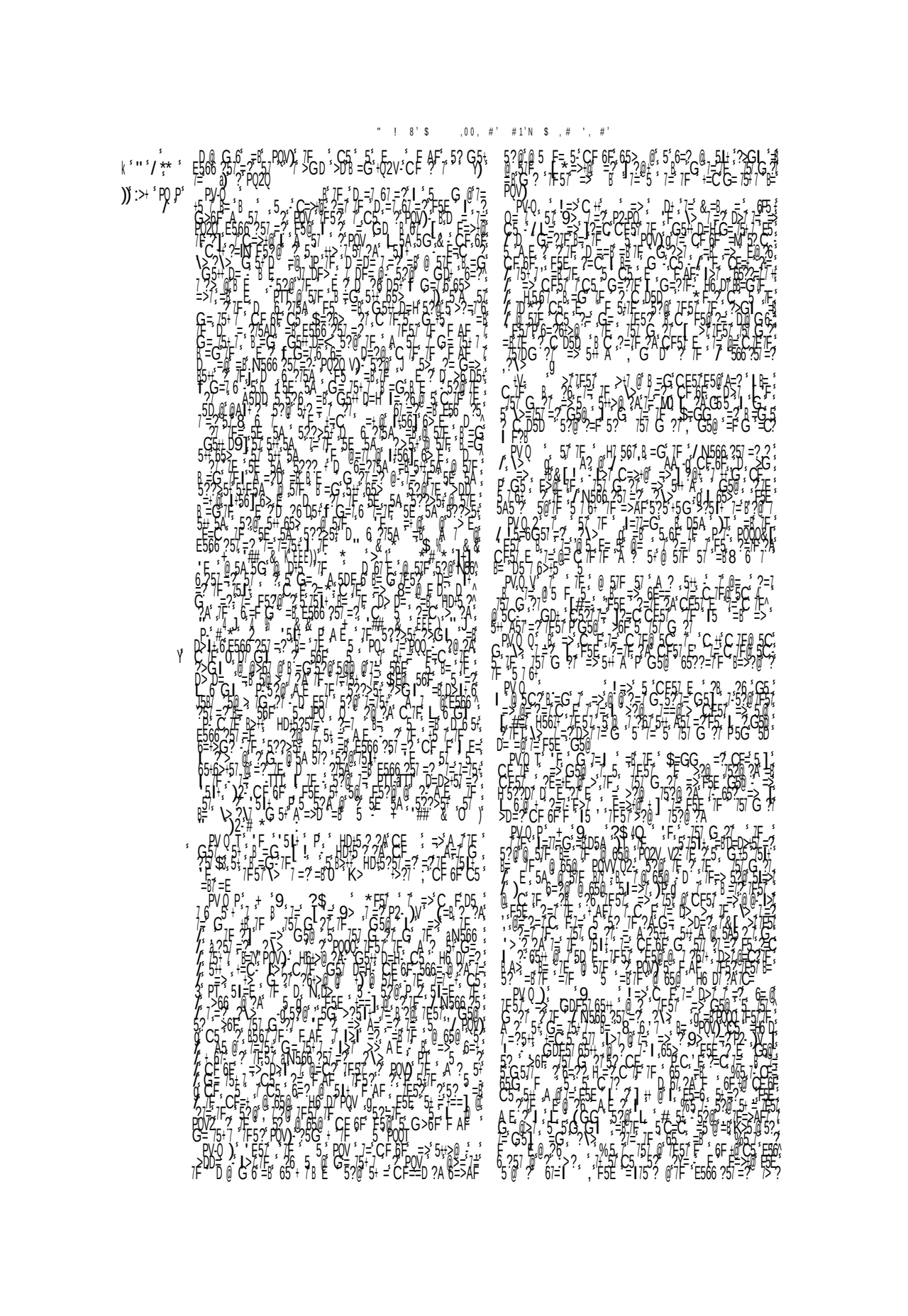

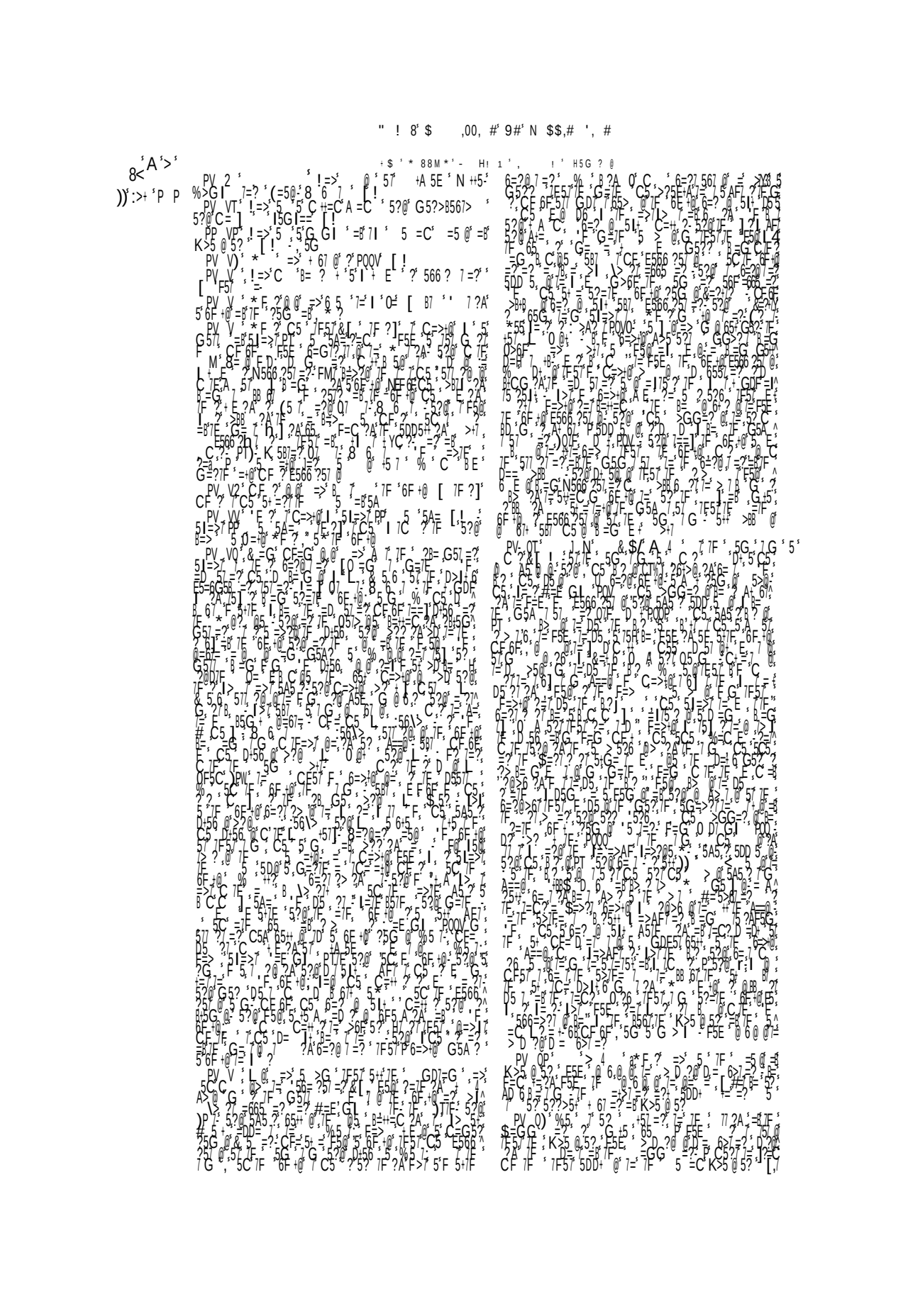

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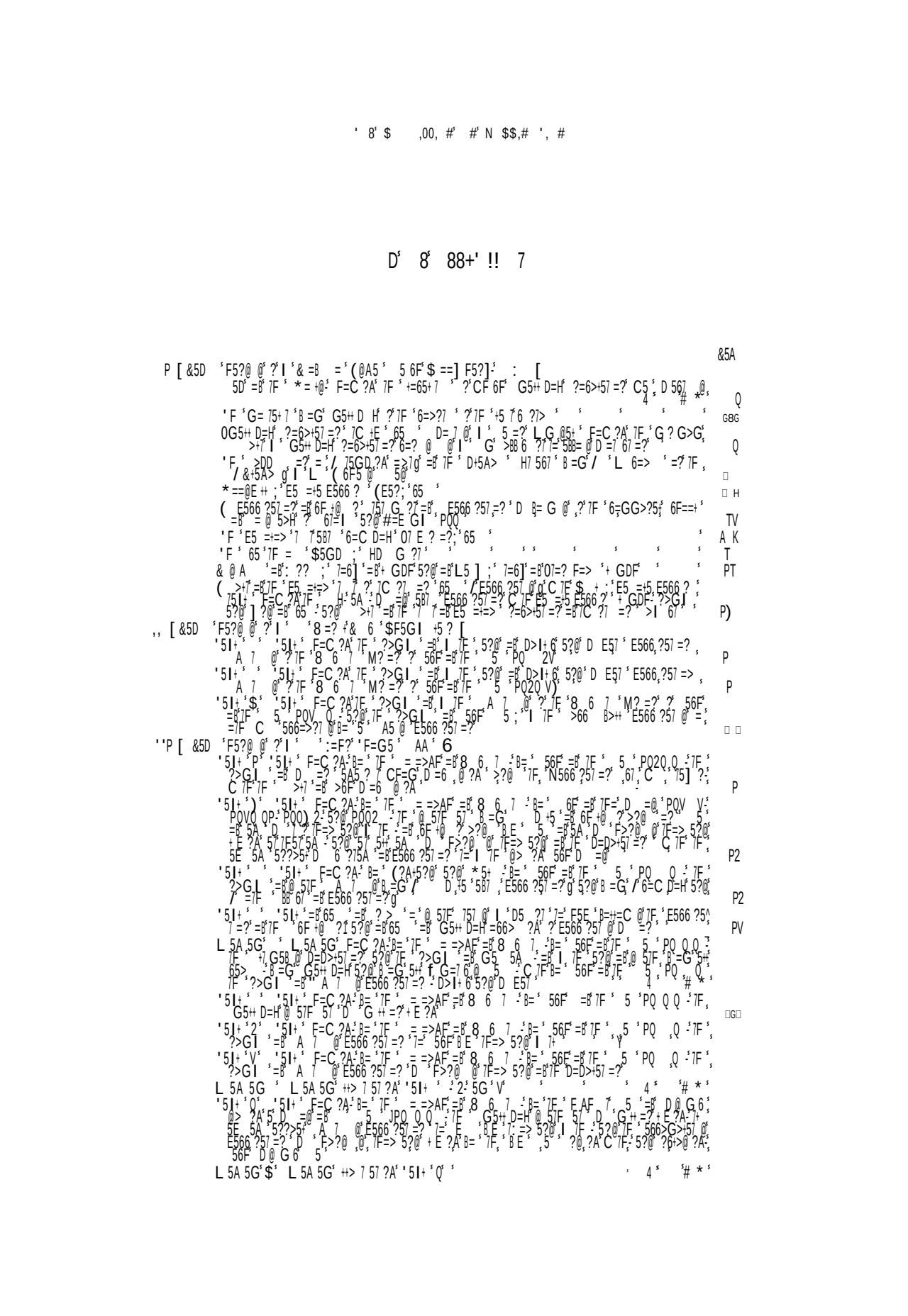
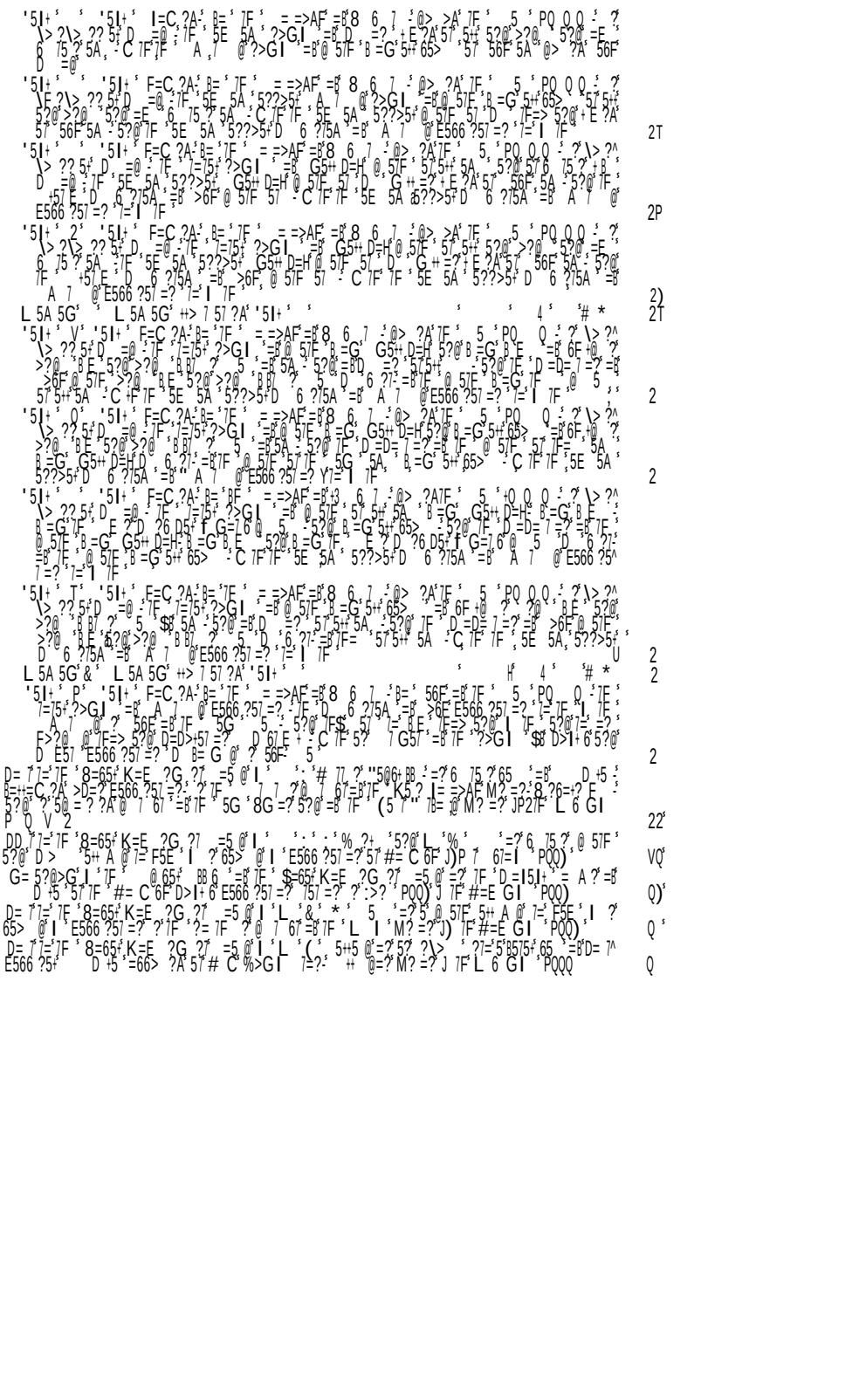
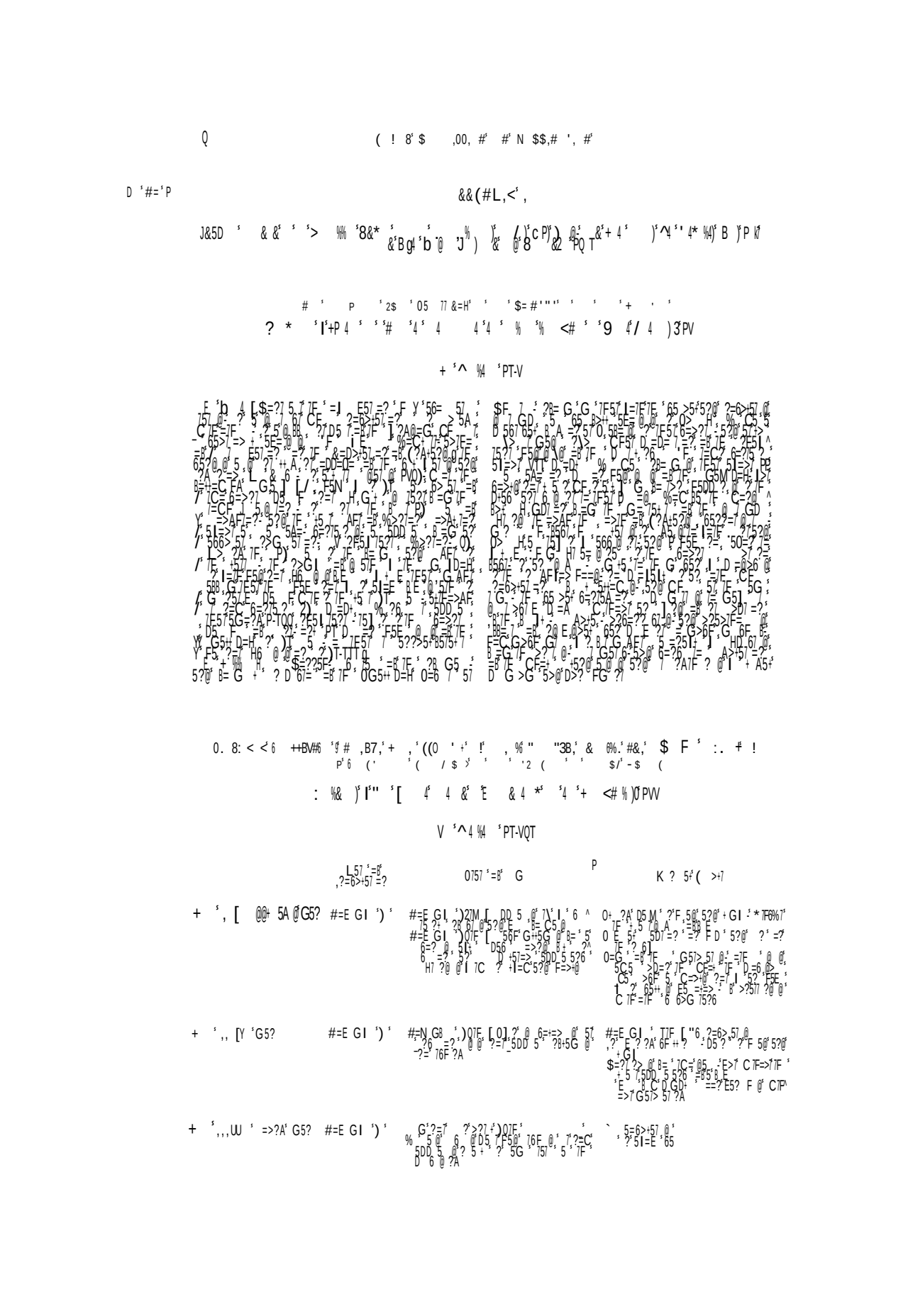
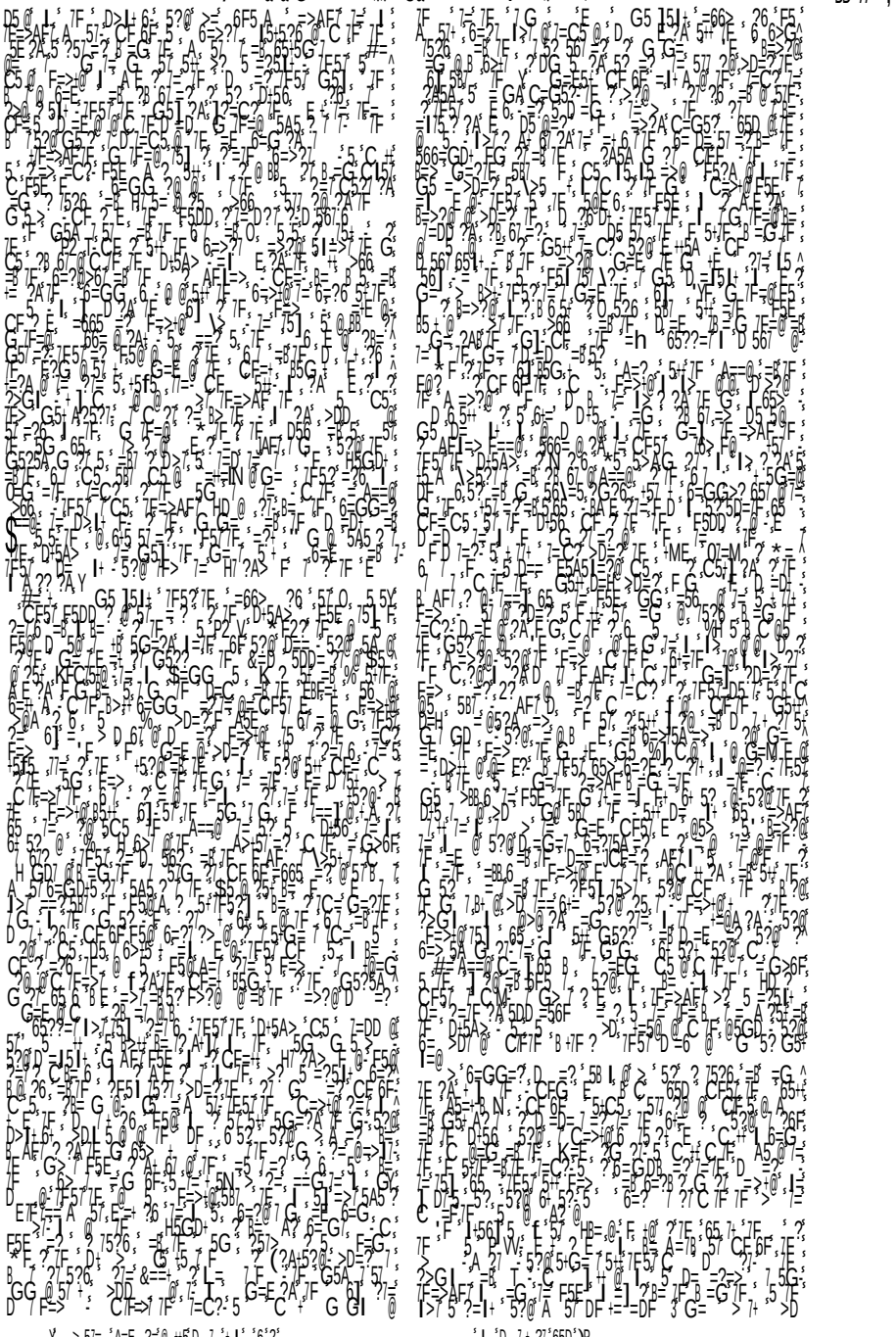
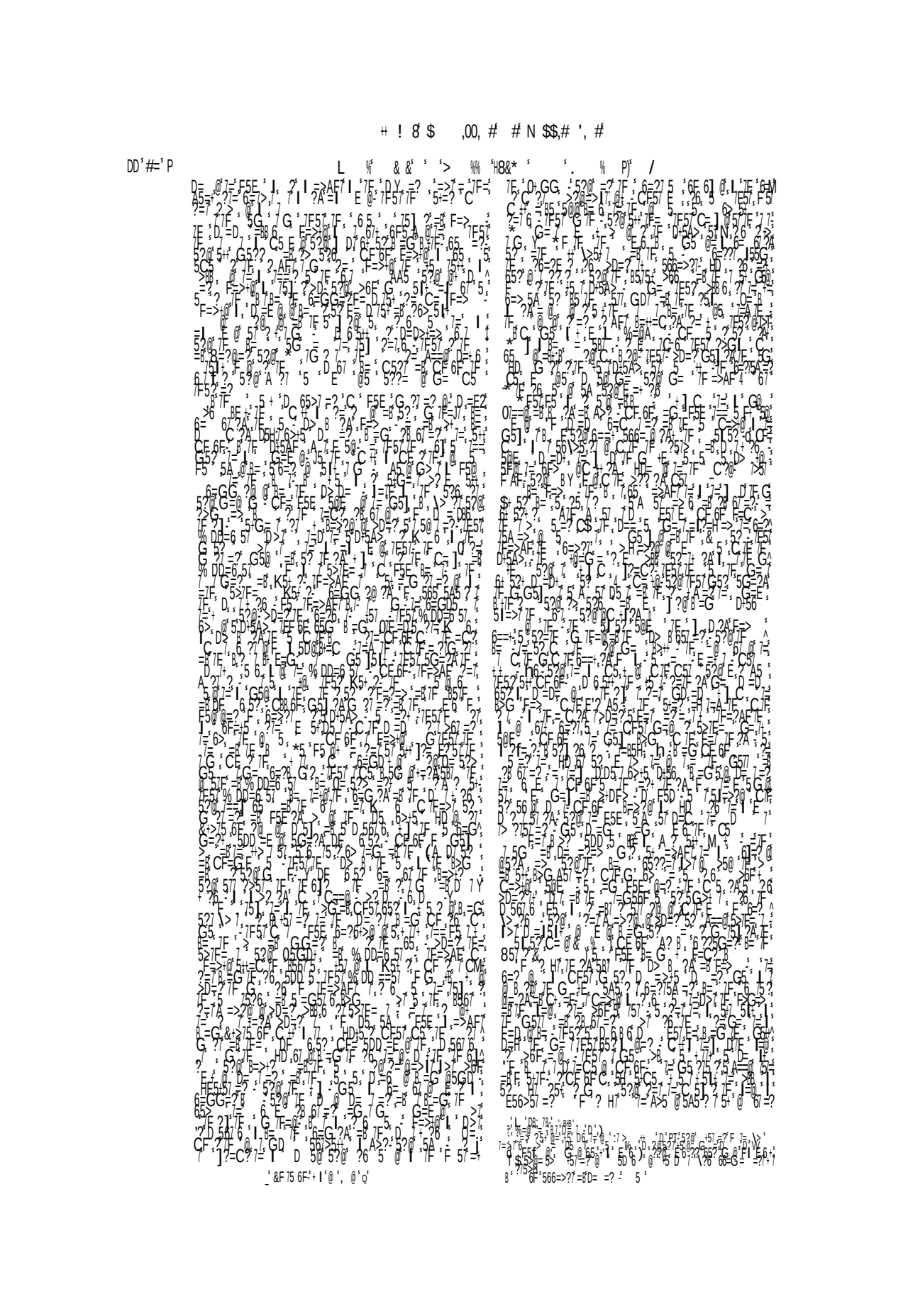


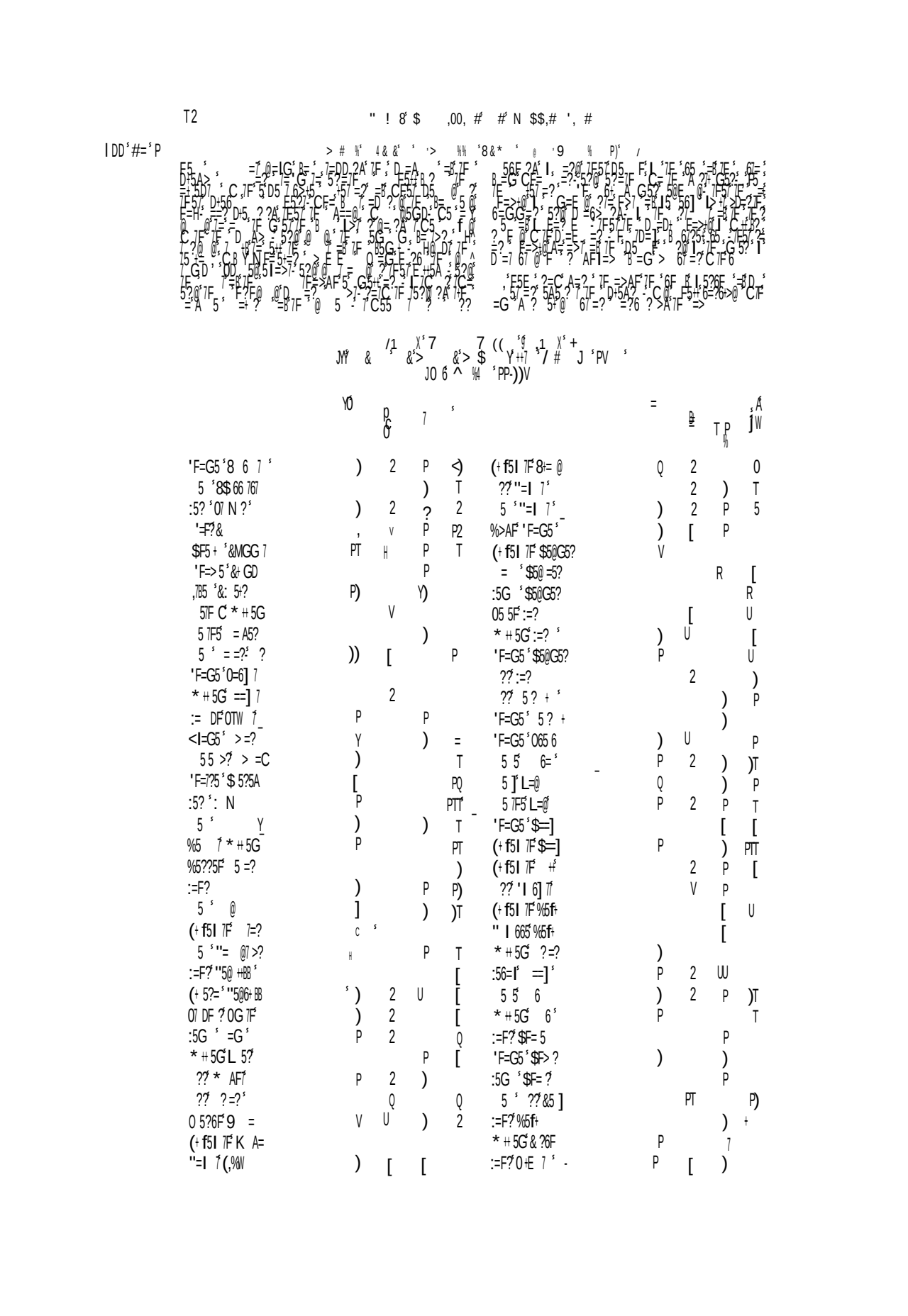


ARCTIC OCEAN
ARCTIC OCEAN
Spitzbergen
Baffin Bay
GREENLAND
Hudson Bay
NORTH AMERICA
ARCTIC CIRCLE
EUROPE
ASIA
BRITISH ISLES
ATLANTIC OCEAN
TROPIC OF CANCER
PACIFIC OCEAN
PACIFIC OCEAN
EQUATOR
EQUATOR
AFRICA
INDIAN OCEAN
SOUTH AMERICA
TROPIC OF CAPRICORN
AUSTRALIA
OCEAN
OCEAN
OCEAN
New Zealand
ANTARCTIC CIRCLE
MAP OF THE WORLD.
SHOWING THE LOCALITIES IN WHICH SMALL-POX INOCULATION WAS PRACTISED.
The localities coloured orange are those in which inoculation was practised from time immemorial.
The countries coloured yellow are those in which inoculation was practised during the eighteenth century.









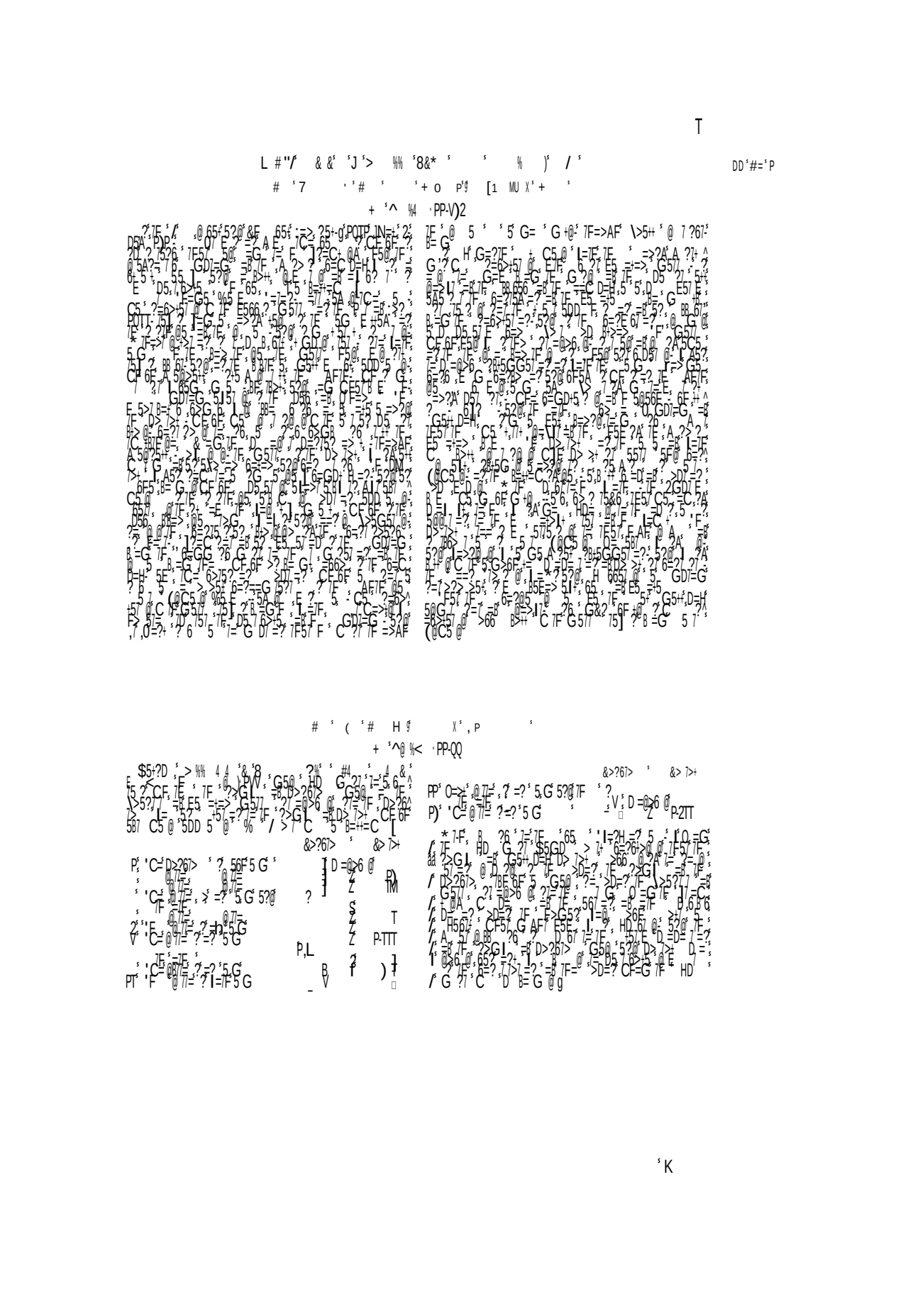
App. No. 1. App. No. 7.

Re-Vaccination or Children. Statement of Re-Vaccinations performed in the Chemical Schools of Bordeaux in October and November 1894.

(*Dr. A. Empêt, "Rapport au Conseil Municipal sur le Service de Vaccination et Revaccination publique pendant l'année 1894."; Bordeaux, 1894.*)

(See Question 11,887.)

Name of the Schools	Dates of Re-Vaccination	6 & 7 years.						7 & 8 years.						8 & 9 years.						9 & 10 years.						10 & 11 years.						11 & 12 years.						12 & 13 years.						13 years and upwards.						Totals.						Remarks.
		Number of Children Re-Vaccinated.	Result Obtained.					Number of Children Re-Vaccinated.	Result Obtained.					Number of Children Re-Vaccinated.	Result Obtained.					Number of Children Re-Vaccinated.	Result Obtained.					Number of Children Re-Vaccinated.	Result Obtained.					Number of Children Re-Vaccinated.	Result Obtained.					Number of Children Re-Vaccinated.	Result Obtained.					Number of Children Re-Vaccinated.	Result Obtained.					Number of Children Re-Vaccinated.	Result Obtained.				
			Boys. Vaccin. Success.	Boys. Vaccin. Failure.	Girls. Vaccin. Success.	Girls. Vaccin. Failure.	Total.



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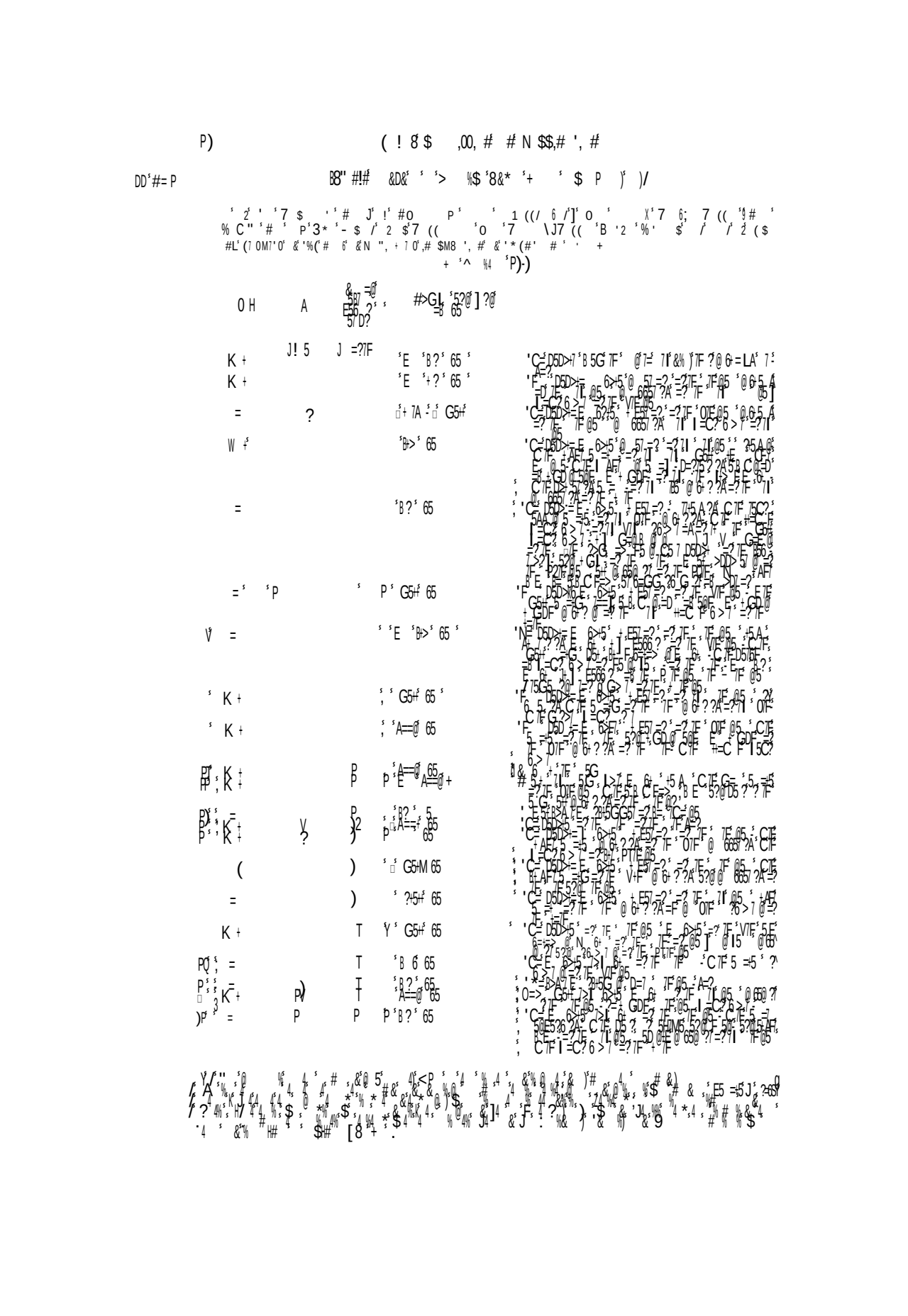

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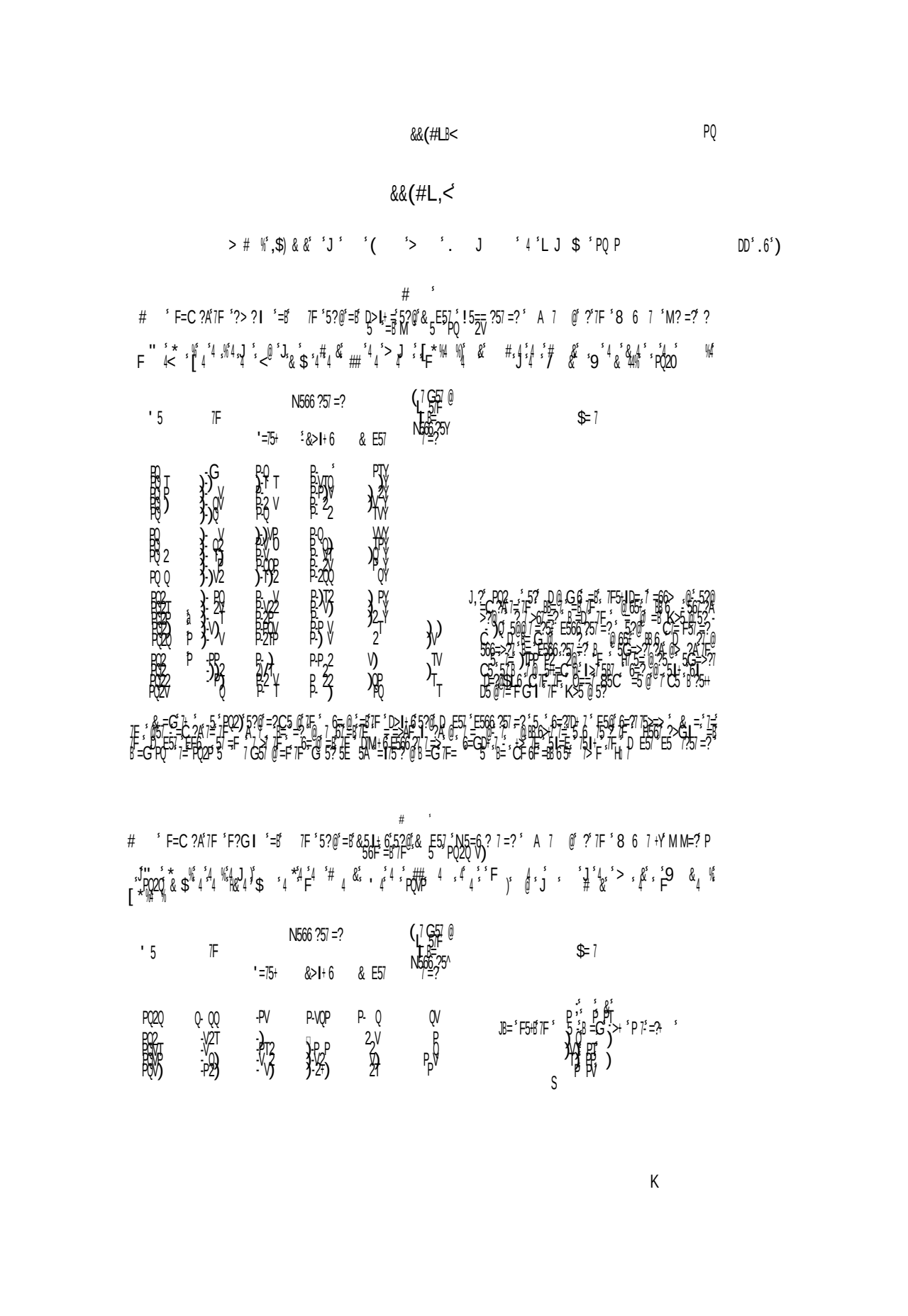

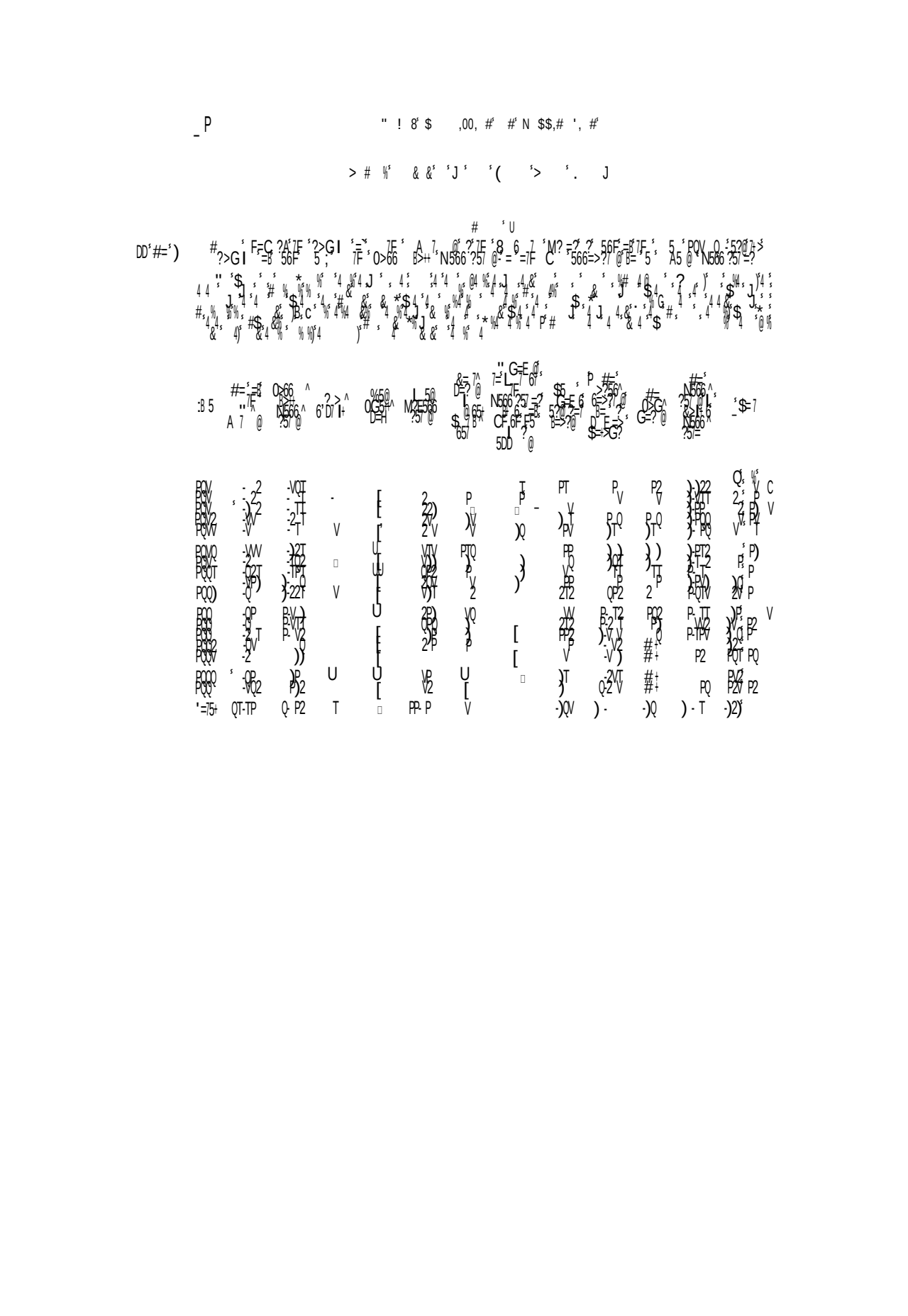

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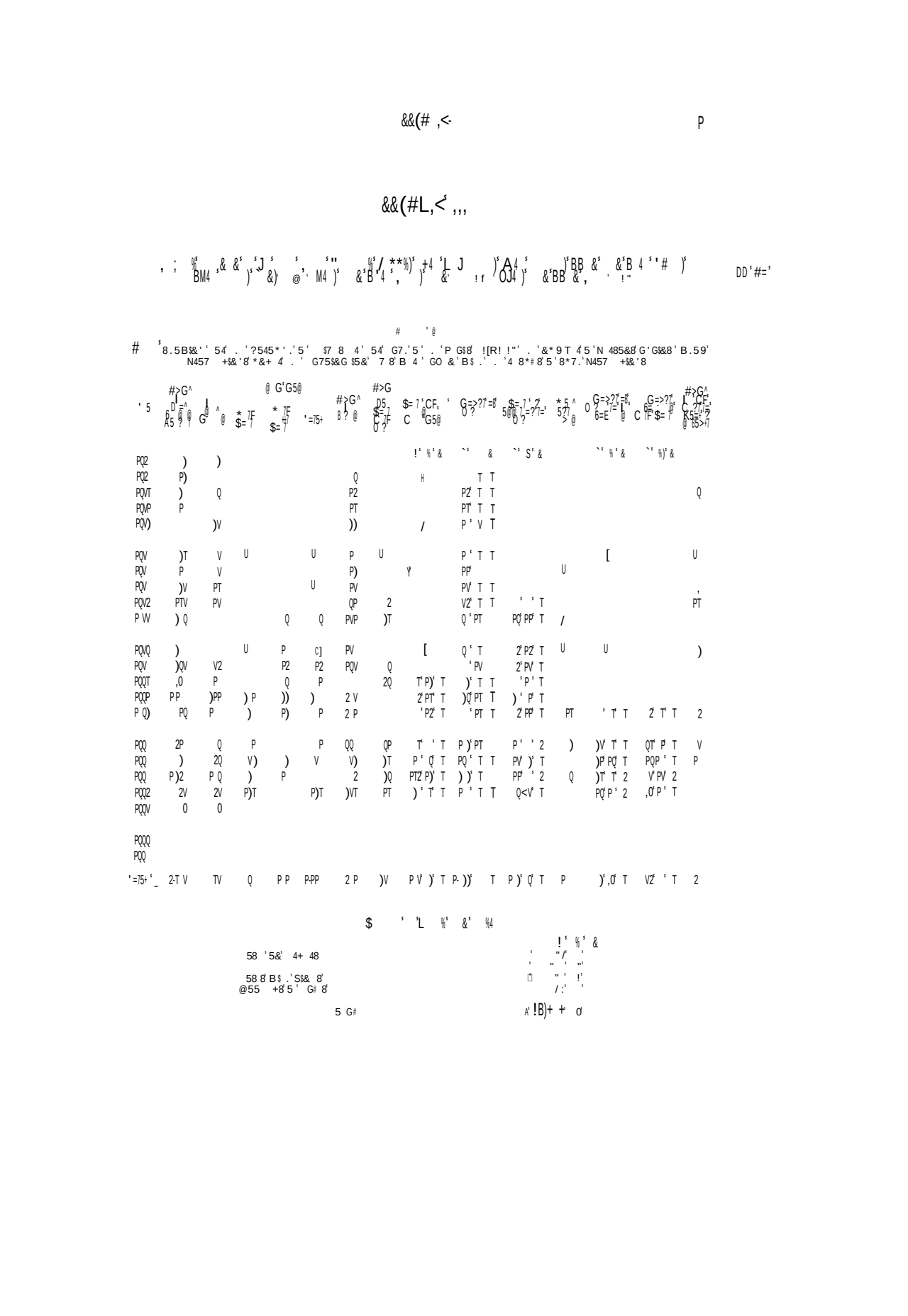

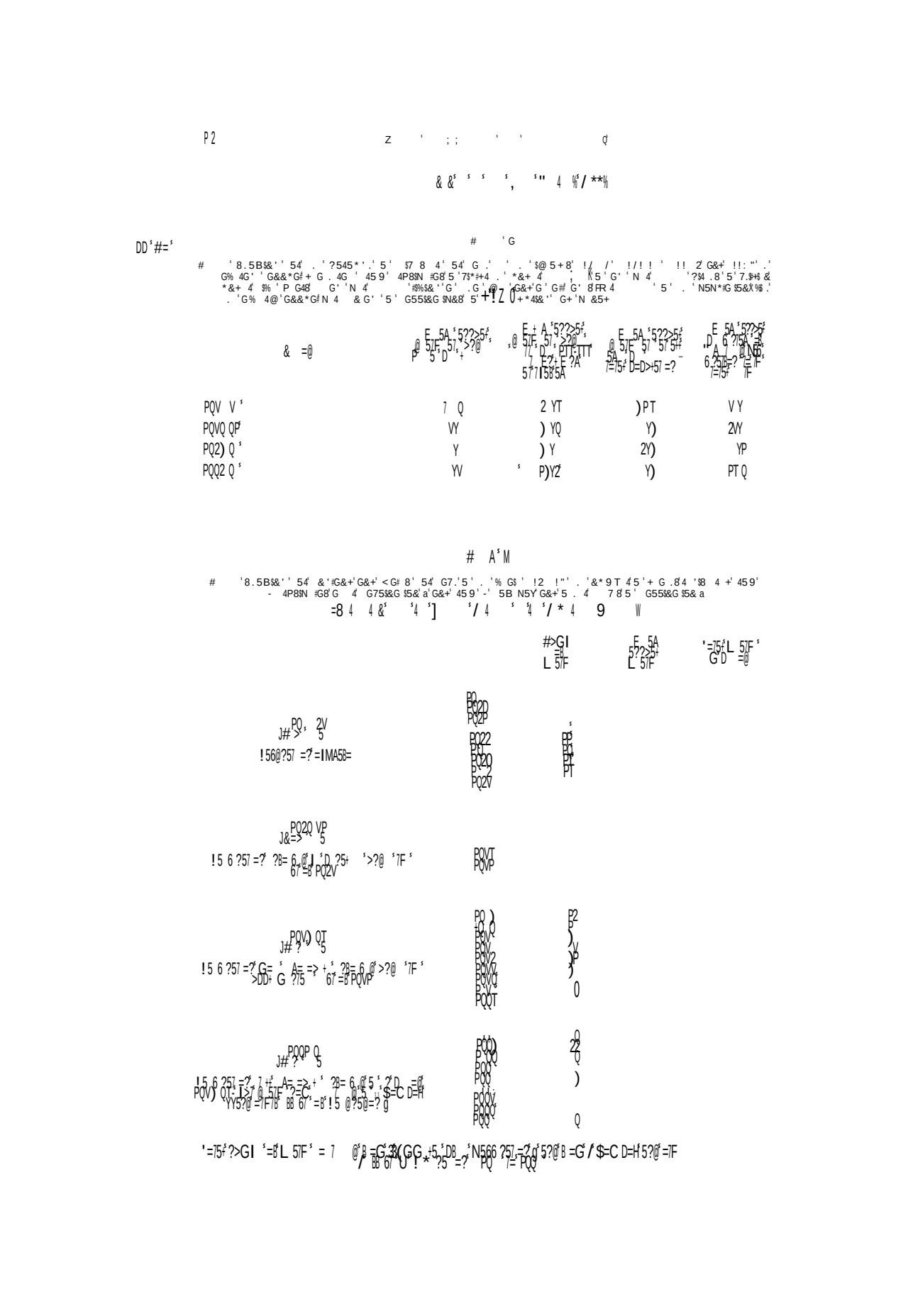

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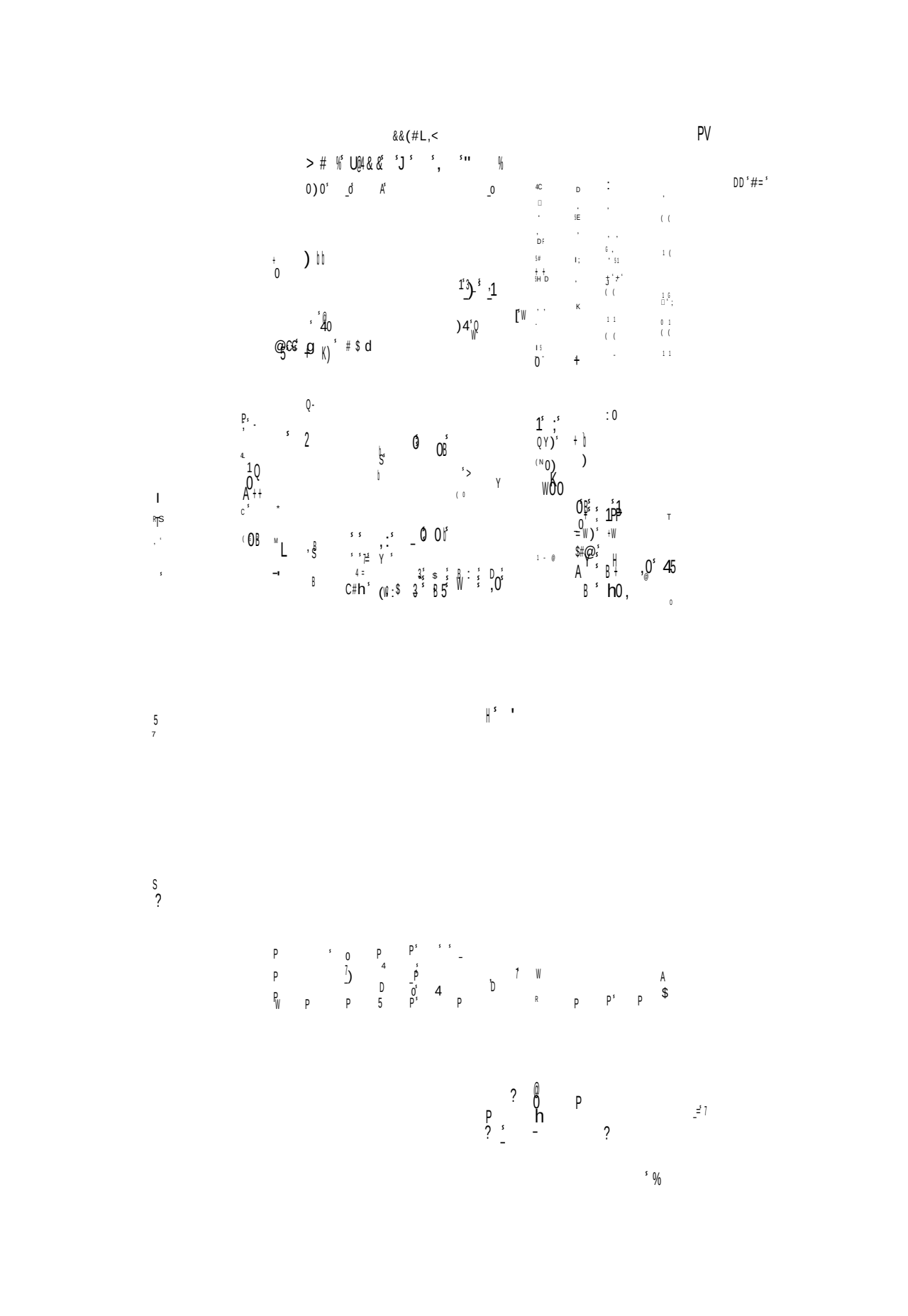

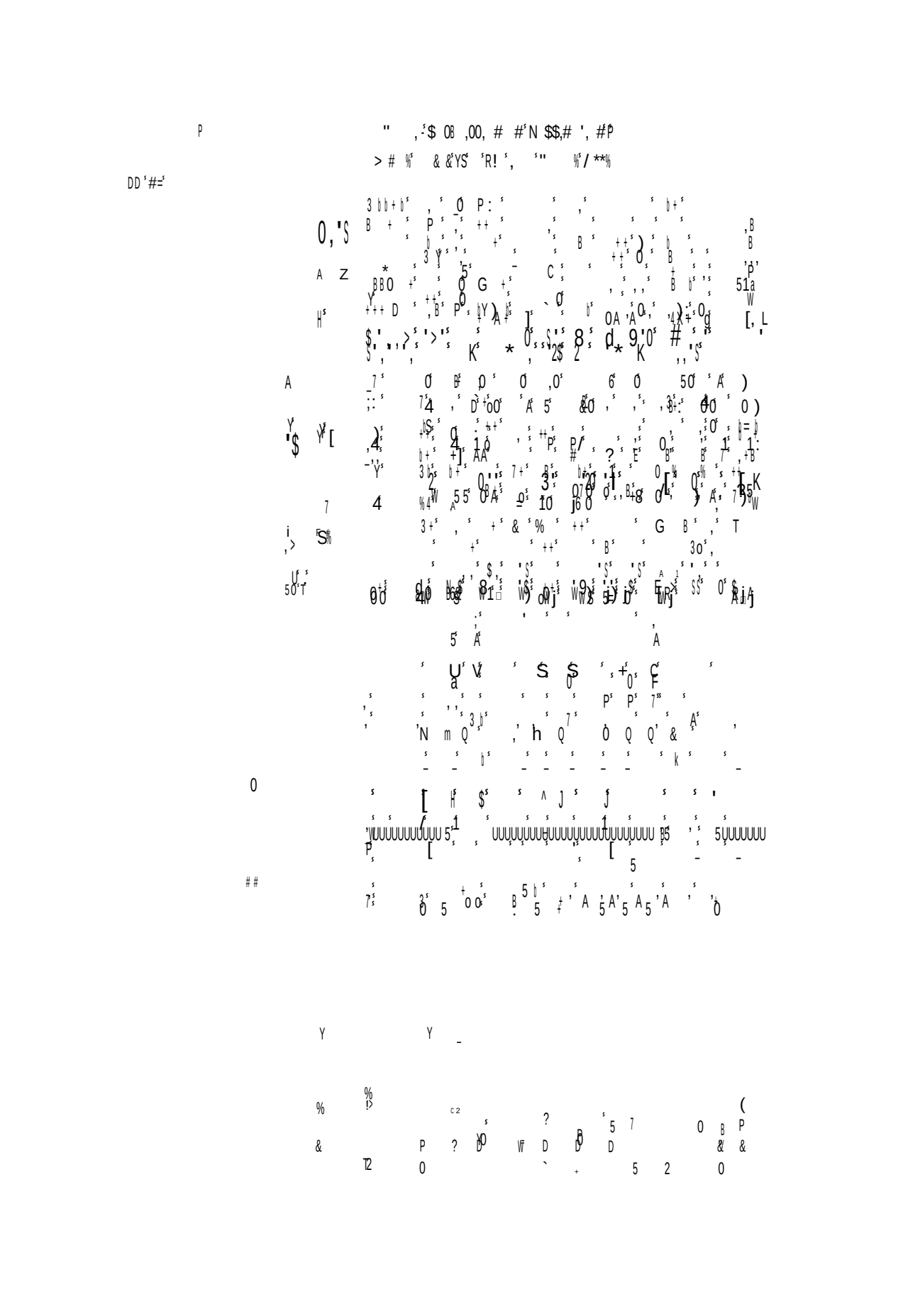

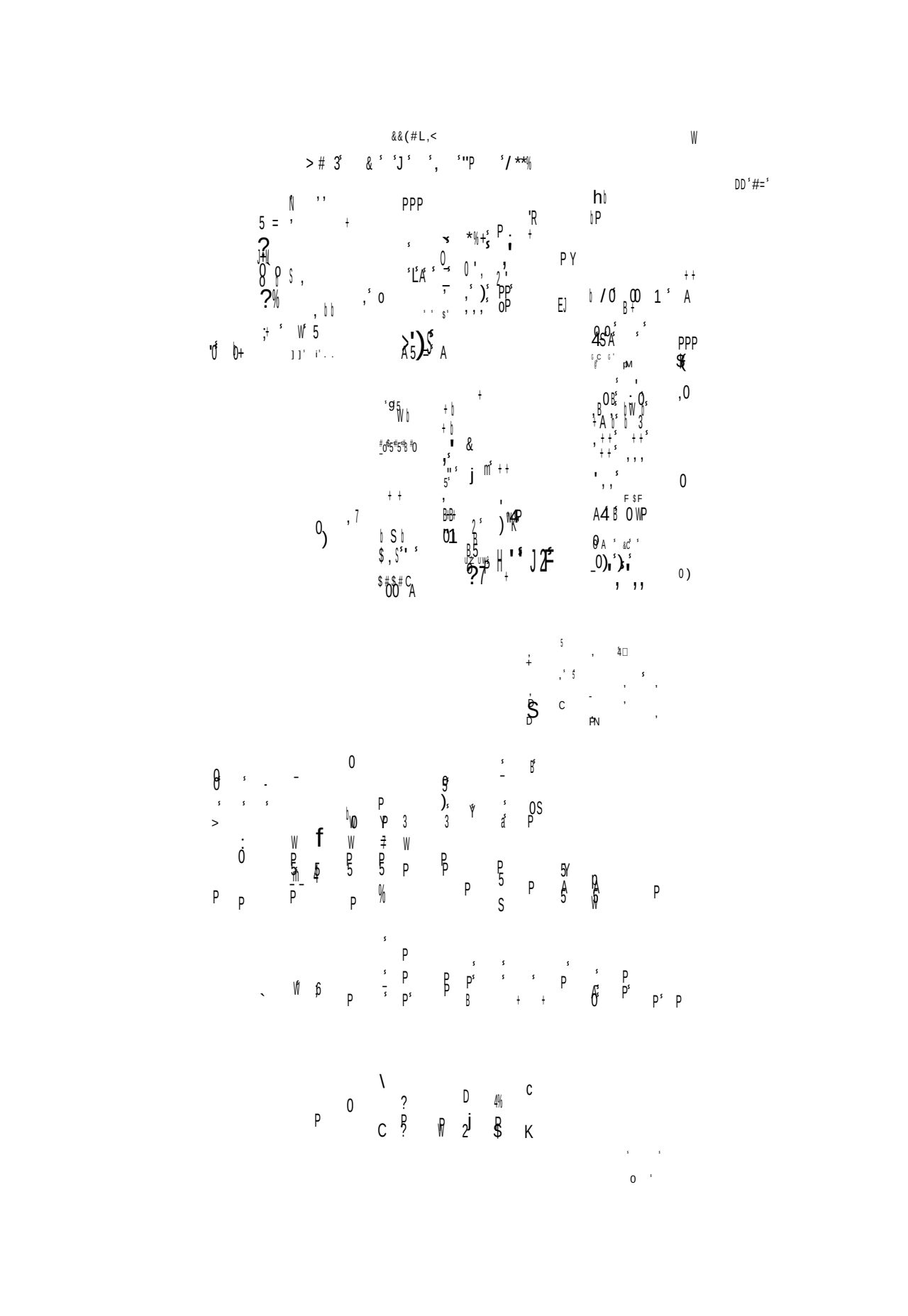

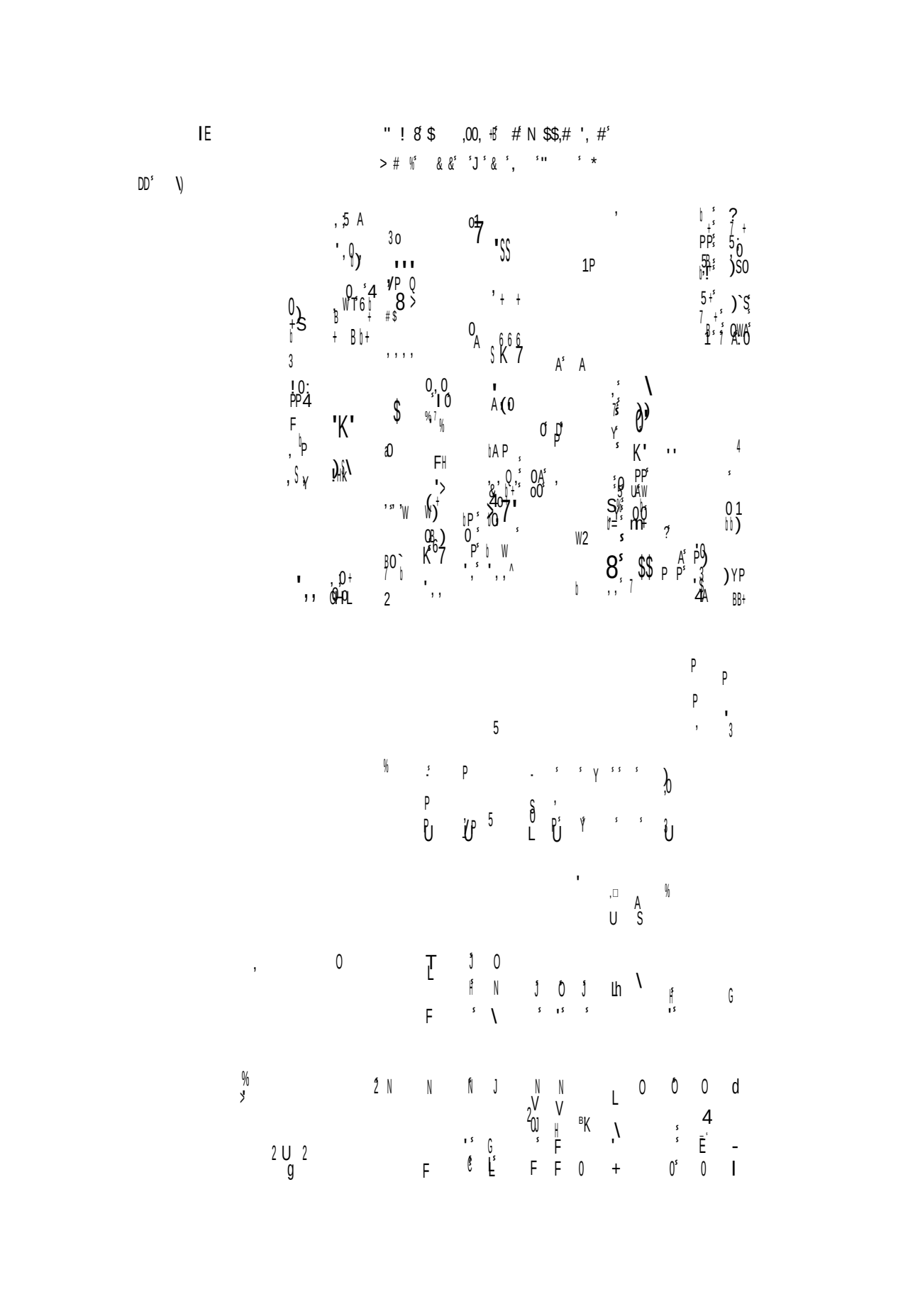

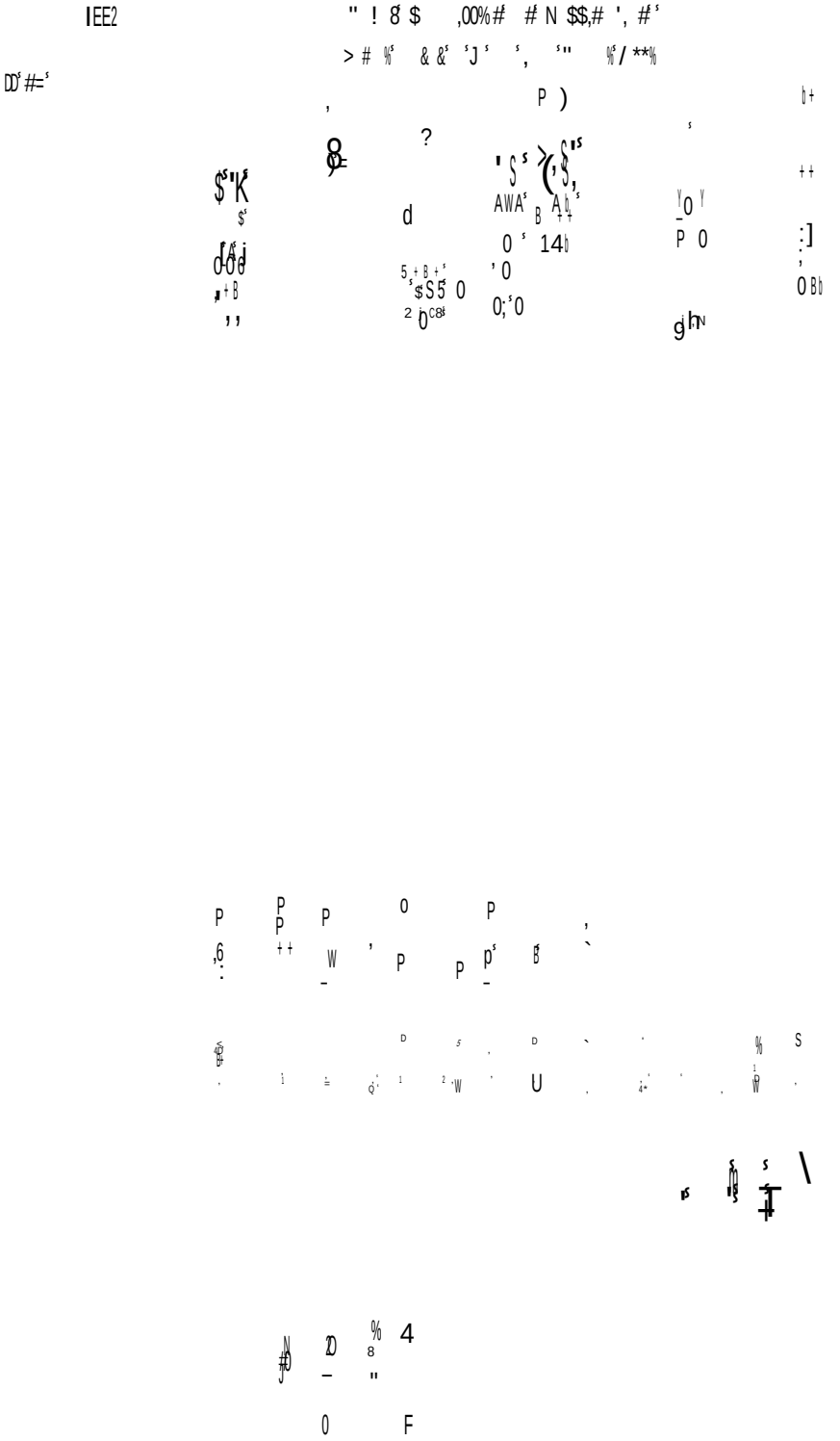

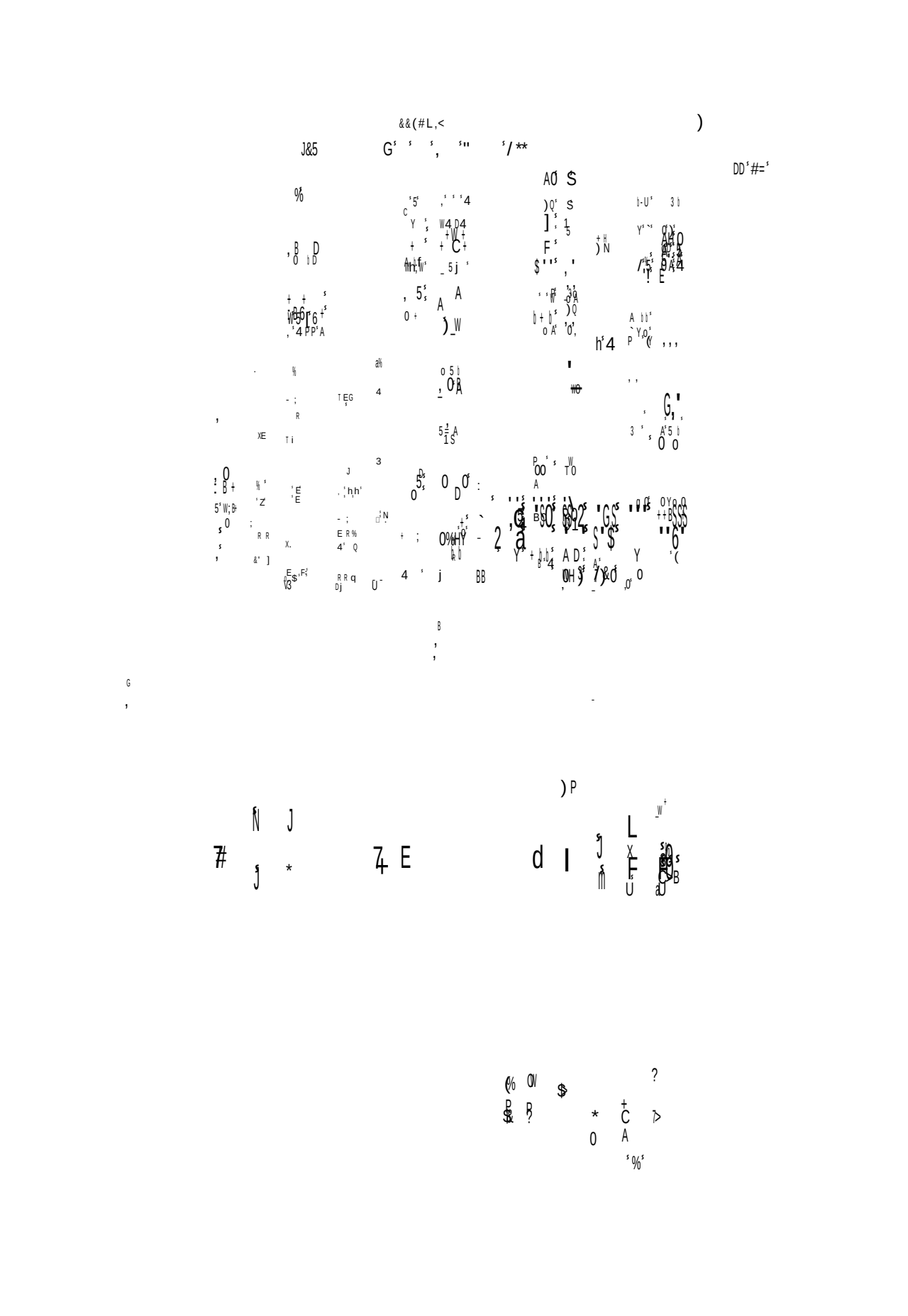

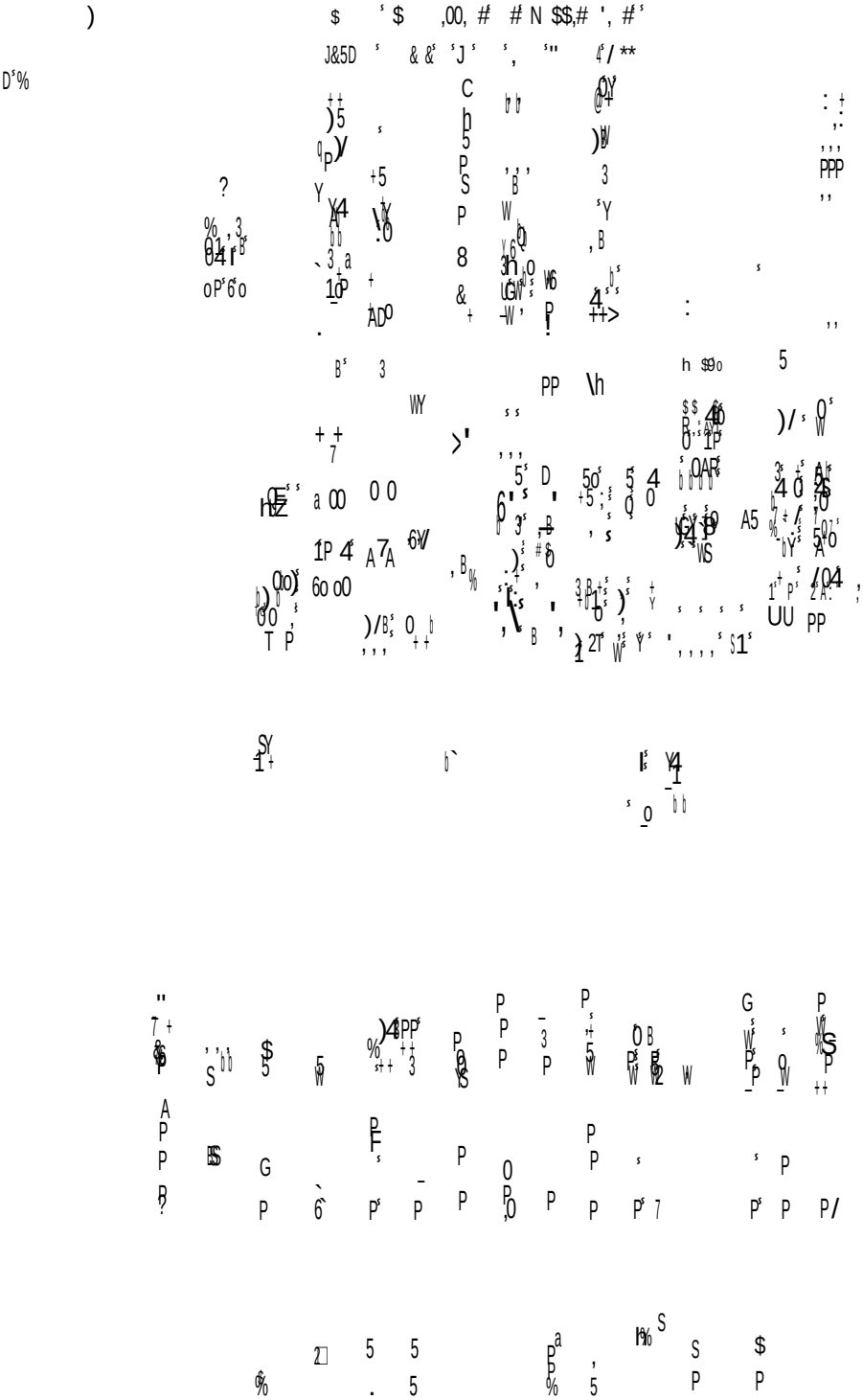

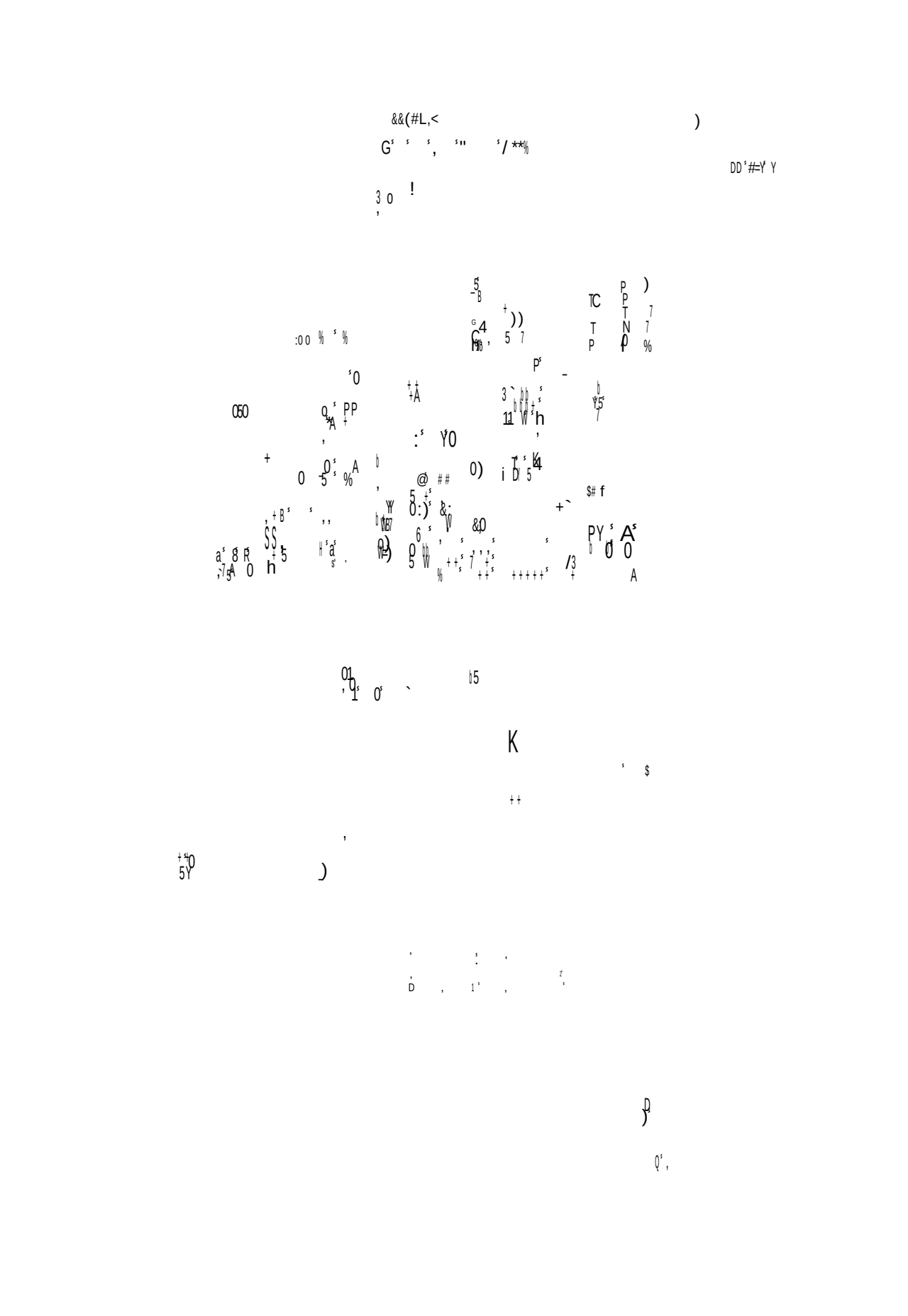

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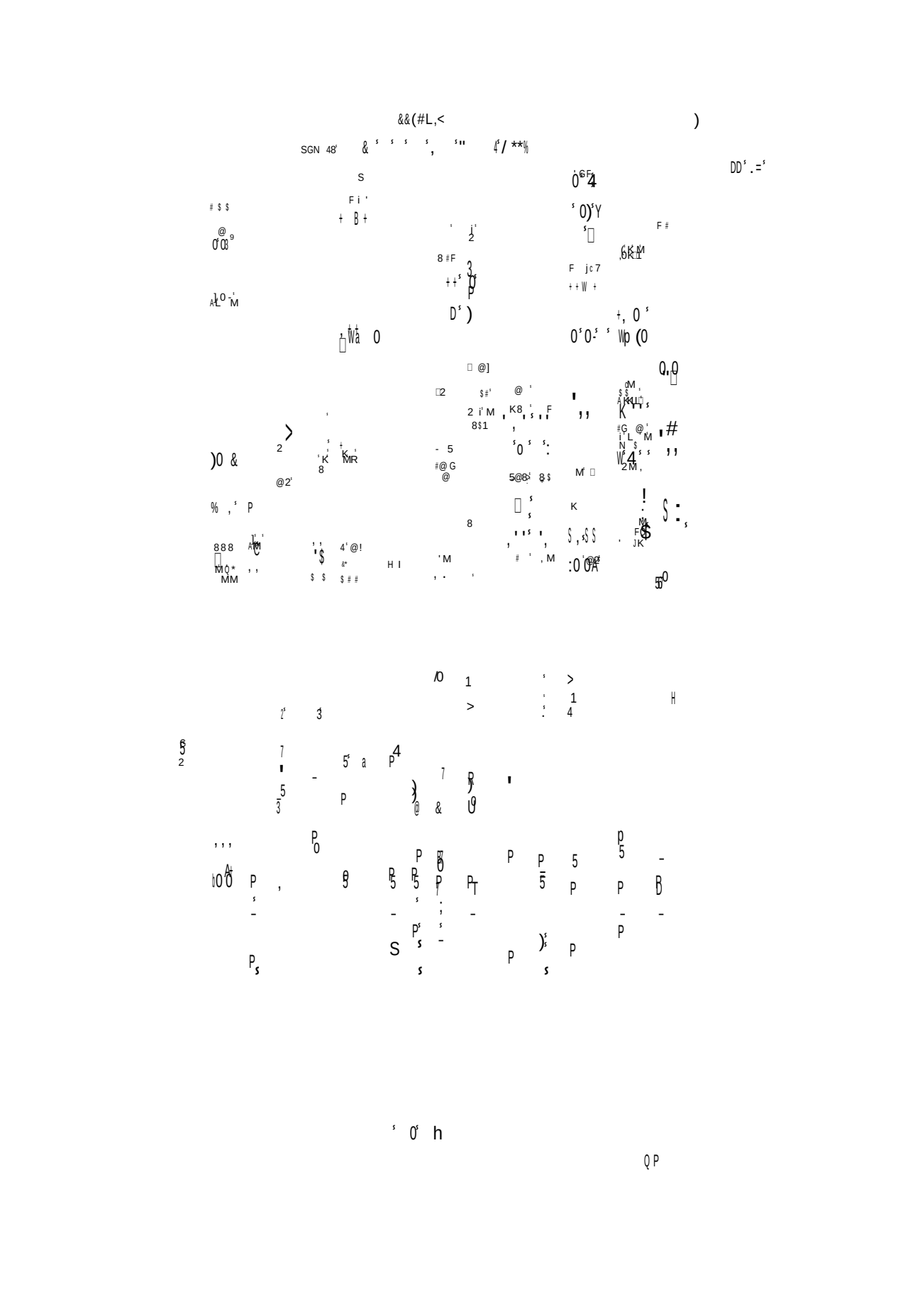
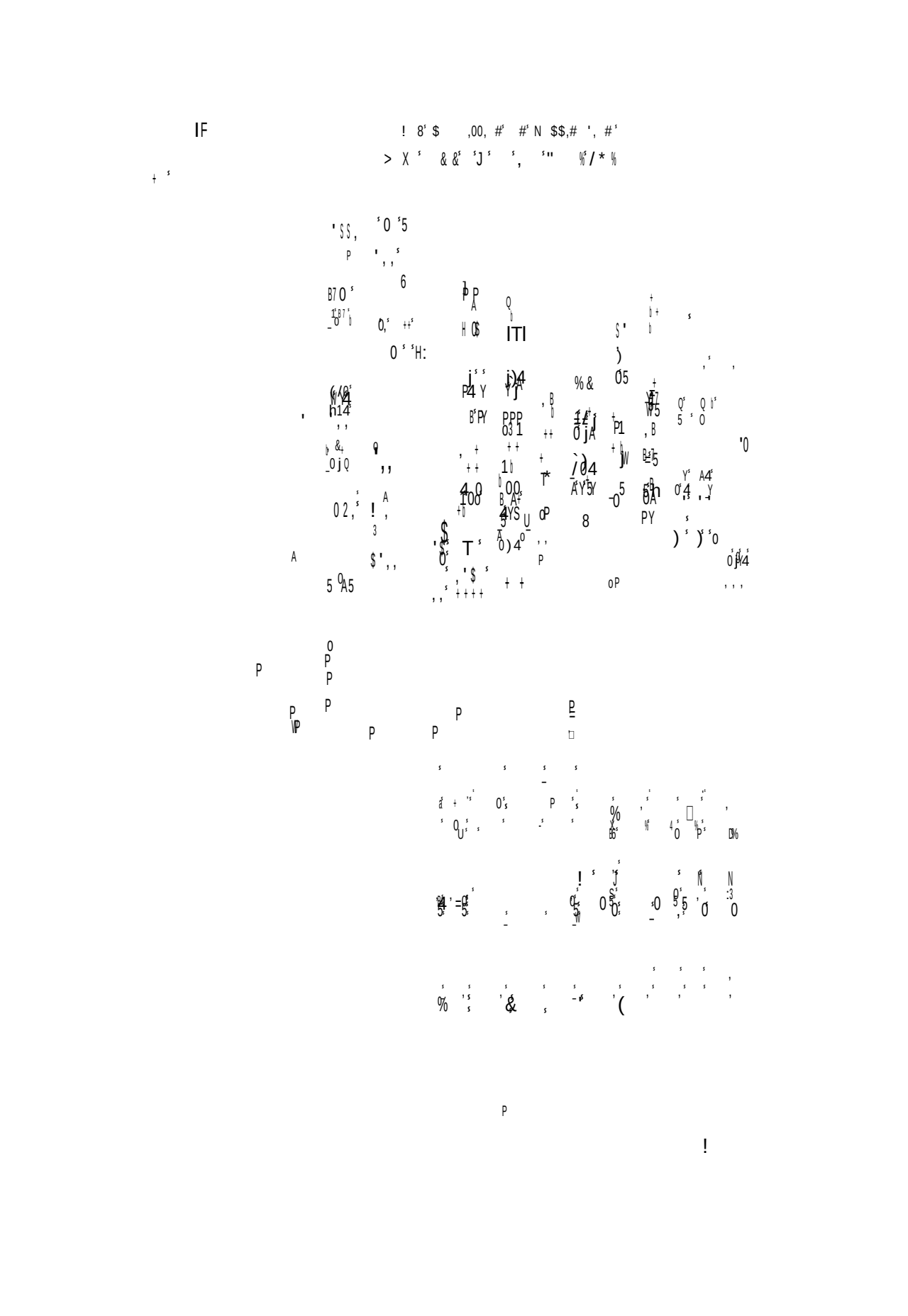
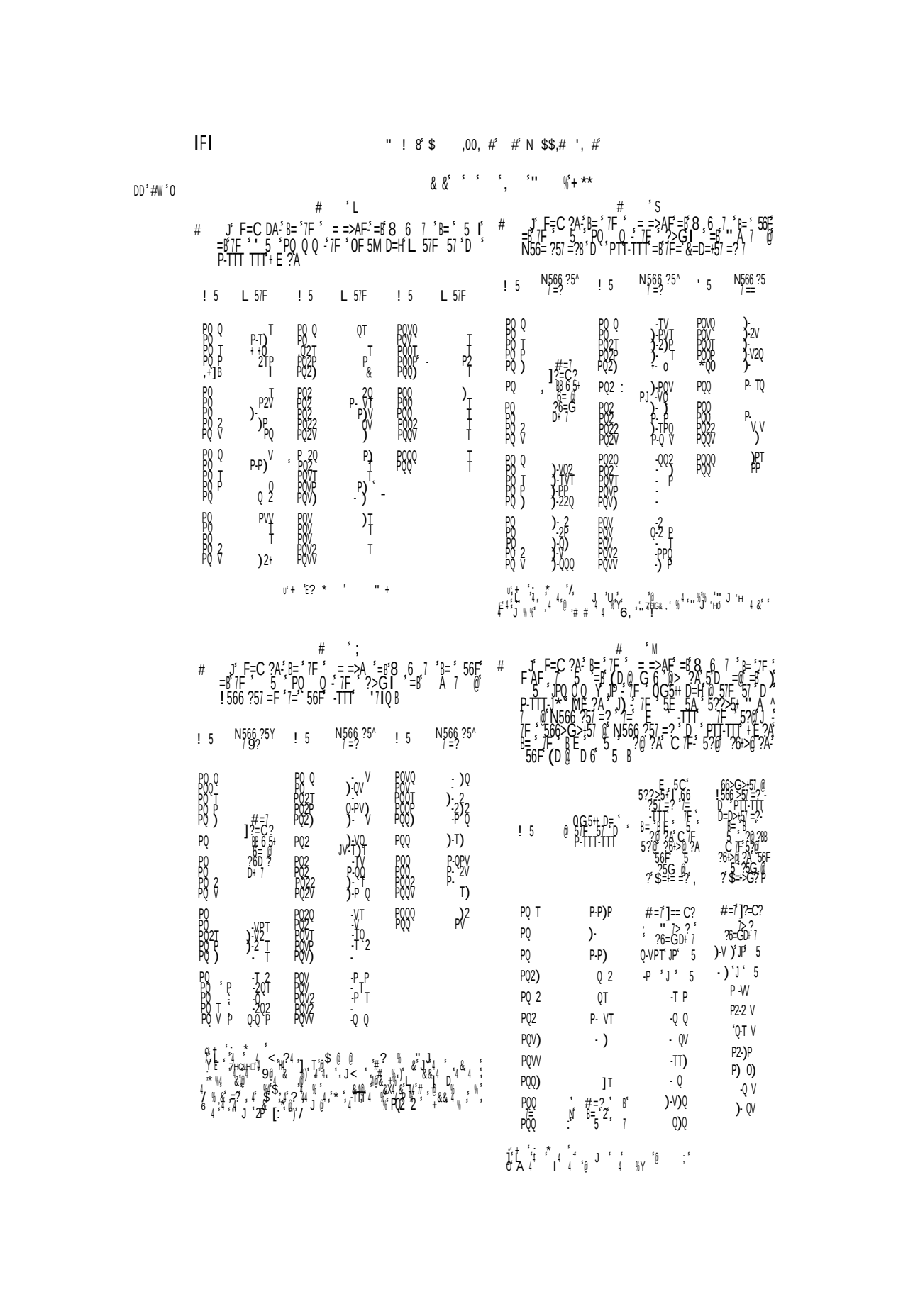


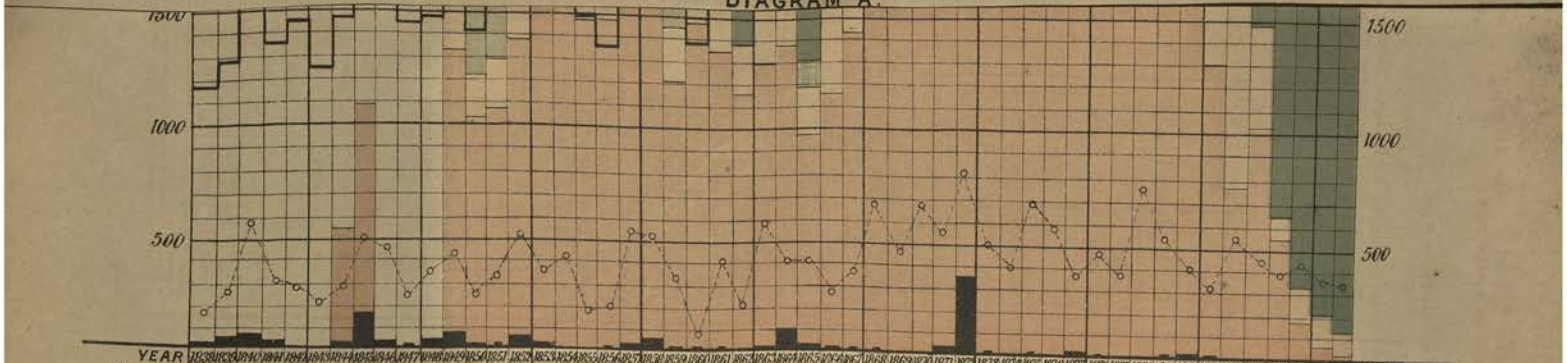




(Papers handed in by Mr. John Thomas Biggs.)

App. No. 3.

DIAGRAM A.



YEAR	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	YEAR.
Marriages	539	560	652	524	590	580	598	658	565	553	607	634	719	641	706	712	642	669	649	671	694	752	668	638	756	895	925	996	1013	951	982	948	986	1105	1174	1209	1060	1184	1230	1183	1107	1141	1177	1150	1201	1205	1152	1114	1220	1089	1136	1211	Marriages.
Births	1815	2074	2067	1972	2045	2035	2067	2287	2213	2005	2008	2171	2218	2237	2387	2283	2457	2364	2307	2402	2411	2526	2586	2567	2540	2775	2697	2916	2726	2917	3086	3086	3260	3962	4162	4447	4324	4220	4281	4255	4729	4697	4960	4717	4857	4825	4651	4683	4883	4686	4804	4926	Births.
* Public Vaccinations							551	1088			1589	1708	1727	1364		1536	1894	1962	1470	1543	1628	1266	1472	1345	1157	1237	1196	969	1358	1435	1731	2357	2143	2764	2937	2266	2706	2715	2188	2038	2104	2036	1904	2173	1807	1300	776	1017	559	169	59	18	Public Vaccinations *
* Private Vaccinations											340	342	226	223	367	377	301	299	313	338	241	294	269	30	364	339	339	261	18	1448	697	963	972	960	1464	1890	1285	1462	1191	1154	1050	1106	776	853	432	924	359	39	158	160	108	Private Vaccinations *
* Total Vaccinations											1929	2050	1953	1587		1913	2221	1824	1783	1881	2026	1977	1766	1619	1187	1601	1925	1308	1633	1835	2179	3254	3106	3738	3357	3350	3500	3400	3650	3509	3260	3066	3060	2946	2660	1732	1700	1316	598	222	219	126	Total Vaccinations. *
Small-pox Deaths	11	50	56	31	0	0	2	169	12	1	31	68	5	2	52	11	0	0	1	17	53	3	2	1	0	5	104	10	3	2	1	0	0	12	38	2	0	1	0	6	1	0	0	2	5	3	0	0	0	0	0	0	Small-pox Deaths.
Zymotic Deaths	155	256	276	213	293	217	293	397	252	234	339	414	347	333	518	339	419	383	280	534	532	333	360	392	294	591	411	909	774	598	685	450	633	556	969	510	398	694	572	353	478	358	729	548	408	332	557	433	388	436	366	325	Zymotic Deaths.
Total Deaths	1180	1265	1230	1058	1136	1253	1433	1689	1443	1357	1487	1615	1413	1354	1773	1680	1801	1490	1361	1796	1894	1638	1381	1733	1602	2299	2047	1965	1895	2108	2495	2252	2199	2558	2496	2648	2409	2550	2888	2166	2313	2547	2654	2969	2564	2537	2641	2780	2736	2668	2665	Total Deaths.
Population	4776	4844	4931	5011	5103	5183	5256	5328	5403	5480	5557	5636	5717	5798	5881	5967	6054	6143	6234	6326	6420	6516	6613	6712	6813	6915	7019	7125	7233	7343	7455	7569	7685	7803	7923	8045	8169	8295	8423	8553	8685	8819	8955	9093	9233	9375	9519	9665	9813	9963	10115	Population.

(In 1863-64 there were 3928 extra vaccinations, performed at the public expense, which are not shown on this diagram.)

**NOTE.—The vaccination figures in the above table were supplied to me by Mr. L. P. Chamberlain, the Clerk to the Vaccination Authority at Leicester. Owing to the criticisms passed upon his figures, I have myself examined the official records and have again taken out the figures, which I give below. As my figures show a more accurate distribution for the various years than those supplied by Mr. Chamberlain, I have used them in preference to his in this Diagram A only, where they are shown by the part coloured red. But in all my other tables and diagrams I have used the figures given in Table 51 (page 465) which are the actual primary vaccinations, irrespective of age, performed in each year. I found the extra vaccinations for 1863-64 were 4320. See footnote to Table 51. J.T.B.*

YEAR	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	YEAR
Public Vaccinations							551	1088			1594	1033	1677	1364		1536	1896	1962	1476	1567	1668	1266	1472	1345	1157	1229	1345	969	1156	1435	1731	2352	2143	2764	2937	2266	2706	2715	2188	2038	2105	2036	1904	2172	1807	1300	776	1017	550	169	59	18	Public Vaccinations
Private Vaccinations											268	207	215	220	307	329	295	295	313	336	241	294	269	231	340	332	214	485	112	1448	697	963	972	960	1464	1890	1285	1462	1191	1154	1050	1106	776	853	432	924	359	39	158	160	108	Private Vaccinations
Total Vaccinations											1862	1240	1892	1584		1865	2191	2257	1789	1903	1909	1560	1741	1576	1497	1569	1689	1454	1268	1547	2428	2840	3736	3897	3226	3796	3930	3376	3241	3210	3072	3076	2609	2253	2076	1876	1409	709	227	217	126	Total Vaccinations

To face page 434

DIAGRAM A.

This diagram shows the total number of births, deaths, small-pox deaths, and zymotic deaths, for each year from 1838 to 1889, inclusive: also the registered public and private vaccinations of each year's births, as far back as obtainable from official sources. The table appended supplies the figures illustrated by the diagram, and contains in addition the marriages and corrected populations for each year.

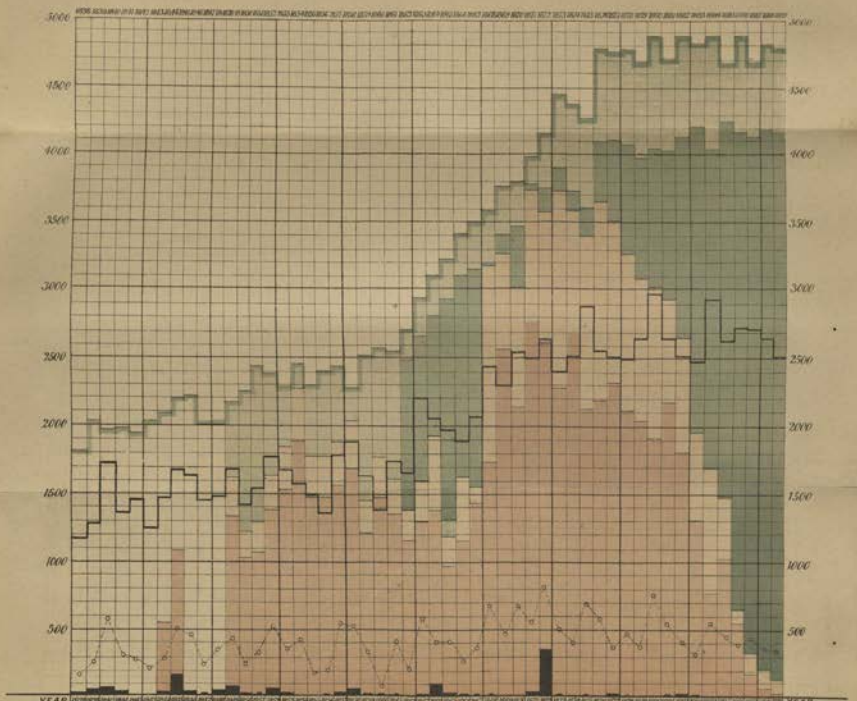
The blue from the base line of the diagram to the upper edge shows the number of births: the light shade (from the year 1868) indicating the proportion of children who died before the notices of the Vaccination Officer were served upon the parents.

The red measured from the base line shows the number of vaccinations*: the light shade indicating the approximate proportion of operations performed by private practitioners.

The upper dark curve (——), measured from the base line, shows the total deaths from all causes.

The lower dotted curves (.....), measured from the base line, shows the deaths from the seven principal Zymotic Diseases, namely, Smallpox, Measles, Scarlet Fever, Diphtheria, Whooping Cough, Fevers (Typhus, Typhoid, and Simple Continued), and Diarrhœa.

The black shows the total Smallpox deaths.



YEAR	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	YEAR
Marriages	330	366	343	324	305	326	336	354	333	307	324	351	345	357	384	411	433	430	421	395	384	373	357	314	290	309	317	348	348	369	386	387	397	377	429	412	419	414	416	419	368	393	387	398	397	387	414	416	391	374	351	340	Marriages
Births	823	826	827	846	826	846	852	843	852	843	871	852	849	857	874	887	890	896	903	903	915	903	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915	Births
* Public Vaccinations																																																					* Public Vaccinations
* Private Vaccinations																																																				* Private Vaccinations
* Total Vaccinations																																																				* Total Vaccinations
Small-pox Deaths	11	30	56	9	9	6	8	8	105	12	1	33	8	2	12	13	10	6	9	17	13	3	2	11	4	1	3	12	3	1	6	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Small-pox Deaths
Zymotic Deaths	215	254	276	203	205	217	203	187	403	254	358	444	345	333	305	339	349	283	300	434	320	333	305	289	251	306	299	281	301	304	299	281	301	304	299	281	301	304	299	281	301	304	299	281	301	304	299	281	301	304	299	281	Zymotic Deaths
Total Deaths	806	795	776	739	744	751	744	739	1005	795	844	1005	795	744	739	795	744	739	795	1005	795	744	739	795	744	739	795	744	739	795	744	739	795	744	739	795	744	739	795	744	739	795	744	739	795	744	739	795	744	739	795	744	Total Deaths
Population	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	1,437,000	Population

(In 1862-64 there were 3326 extra vaccinations, performed at the public expense, which are not shown on this diagram.)

*NOTE.—The vaccination figures in the above table were supplied to me by Mr. T. P. Chamberlain, the Clerk to the Vaccination Authority at Leicester. Owing to the criticisms passed upon his figures, I have myself examined the official records and have again taken out the figures, which I give below. As my figures show a more accurate distribution for the various years than those supplied by Mr. Chamberlain, I have used them in preference to his in this Diagram. A only, where they are shown by the part coloured red. But in all my other tables and diagrams I have used the figures given in Table 51 page 465, which are the actual primary vaccinations irrespective of age performed in each year. I found the extra vaccinations for 1862-64 were 4320. See footnote to Table 51. J.T.B.

YEAR	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	YEAR
Public Vaccinations																																																					Public Vaccinations
Private Vaccinations																																																						Private Vaccinations
Total Vaccinations																																																					Total Vaccinations

(Papers handed in by Mr. John Thomas Biggs.)

DIAGRAM B, *illustrating Tables 5, 6, and 7.*

This diagram shows (1) *An enormous rise in Small-pox mortality after a quarter of a century of continuous vaccination up to* 1872, *which period ends with five years' penal enforcement of vaccination, and the highest Small-pox epidemic known in Leicester for more than fifty years;*

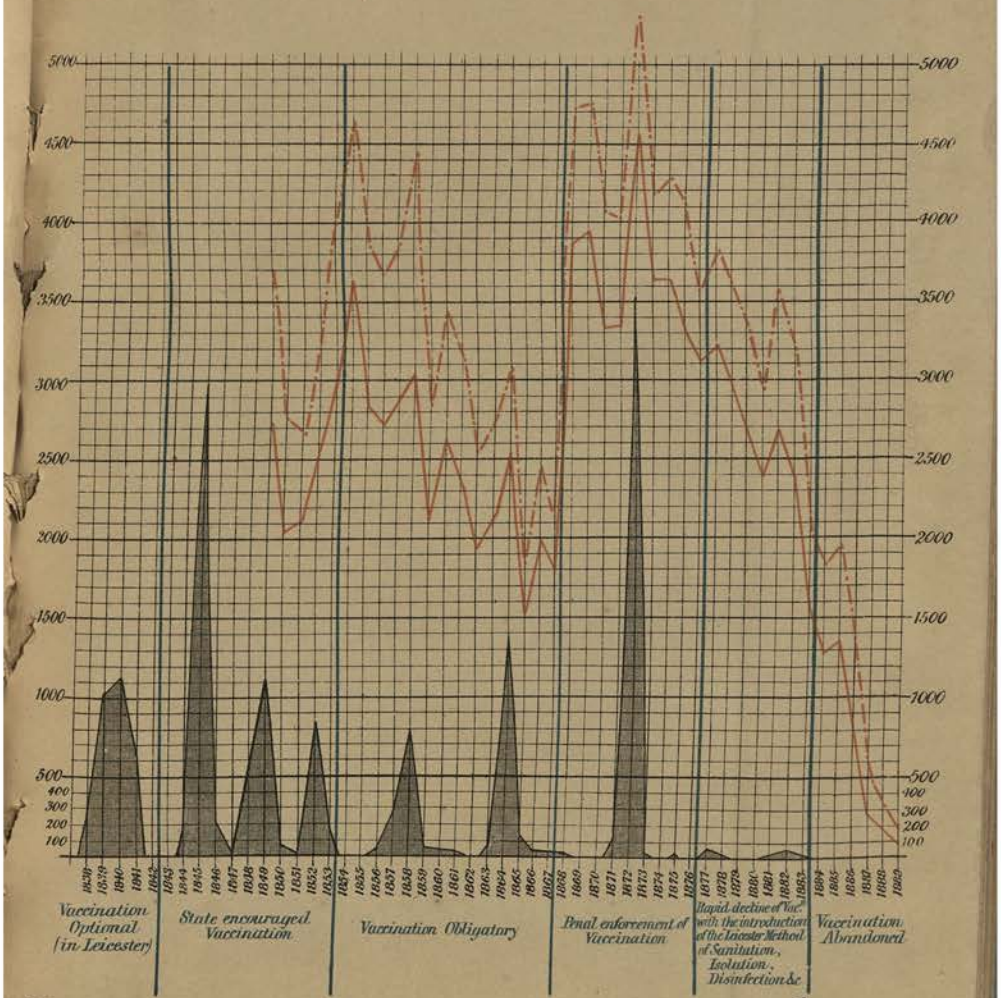
(2) *From* 1872 *a rapid decline in vaccination is observable, and is coincident with our lowest known rate of Small-pox mortality, and with the introduction of the Leicester treatment of this disease;*

(3) *With the abandonment of vaccination and the perfecting of the "Leicester Method" of Sanitation, Isolation, Quarantine, Disinfection, &c., during the last six years Small-pox mortality becomes extinct.*

Black Pyramids — *Annual deaths from Small-pox per million of population.*

Red dotted curve — *Annual registered vaccinations to* 5,000 *births.*

Red curve — *Annual registered vaccinations per* 100,000 *population.*



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(Papers handed in by M^r. John Thomas Biggs.)

DIAGRAM C, *illustrating Table 8.*

This Diagram shows (1) *Highest epidemic years of Small-pox mortality (per million living) in each of seven successive epidemics from* 1838 *to* 1872, *ending with the most fatal epidemic year* (1872), *after a quarter of a century of continuous vaccination;*

(2) *Two invasions of Small-pox subsequent to* 1872, *when vaccination was falling into discredit, both of which invasions were speedily stamped out by the "Leicester Method" of treatment;*

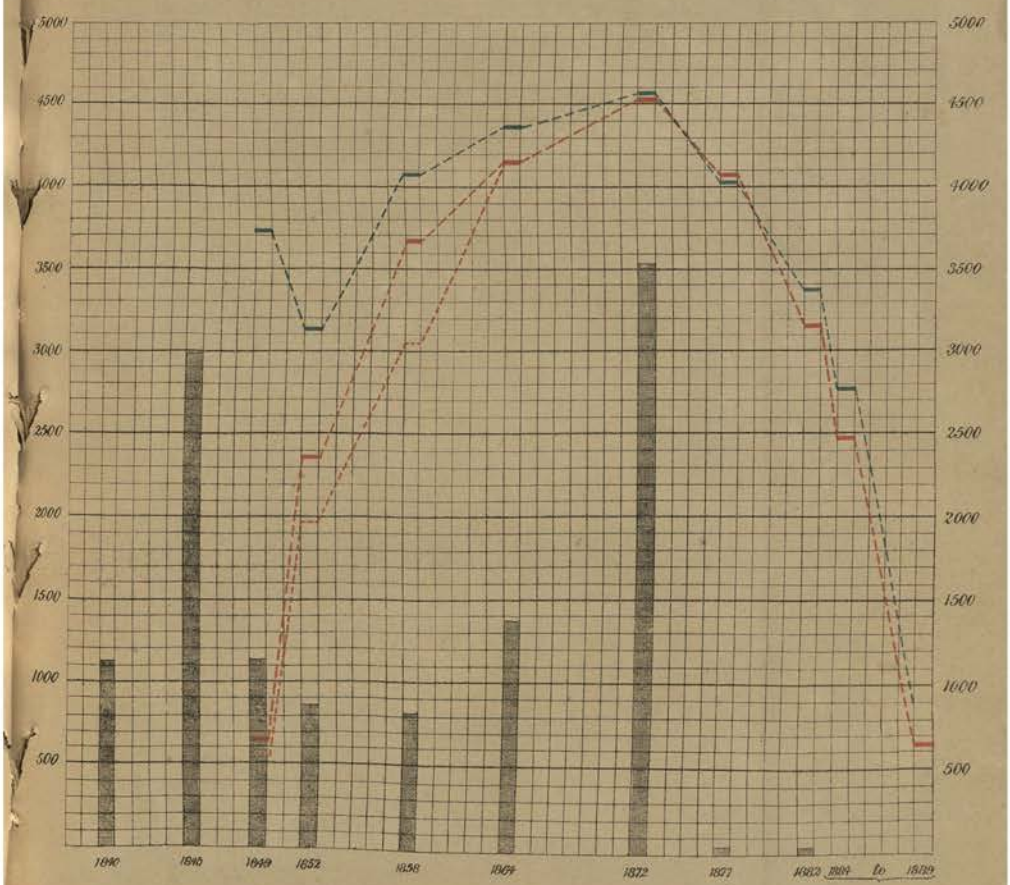
(3) *Vaccination being practically abandoned, and the "Leicester Method" of Sanitation, Isolation, Quarantine, Disinfection, &c., being meanwhile perfected, Small-pox mortality entirely disappears after* 1883, *notwithstanding a considerable number of importations of the disease into the town, mostly from well vaccinated districts.*

Black columns — *Small-pox per million of population.*

Blue curve — *Average annual registered vaccinations to* 5,000 *births, for* 5 *years ending with and including each year shown on diagram.*

Red curve — *Accumulated registered vaccinations for* 5 *years (as above) per* 100,000 *population. (Twenty-five per cent. only is shown so as to bring the curve within the compass of the diagram.)*

(The space between solid and dotted curves shews the addition for private vaccinations, 1849-62.)



No Small-pox deaths since 1883.

To face page 434.

(Papers handed in by Mr John Thomas Biggs.)

DIAGRAM D.

This diagram shows (1) *The total number of Small-pox cases which have occurred (or come to the knowledge of the Medical Officers of Health), in and near Leicester, since the subsidence of the great epidemic of* 1871-73. *Most of these cases were due to importations from efficiently vaccinated towns and districts.*

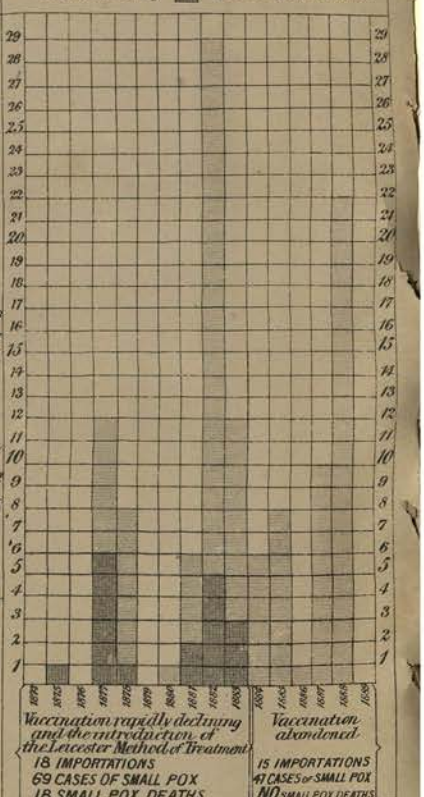
(2) *Of the total number of* 116 *cases, sixty-nine occurred during the years* 1877-83. *Out of these* 69 *cases eighteen deaths resulted, giving a fatality of* 26·1 *per cent. Of the* 47 *cases which occurred during* 1884-89 *no deaths resulted, thus giving a mean fatality of* 15·5 *for the whole* 116 *cases.*

From 1874 *to* 1889 *inclusive, during a period of* 16 *years, no fewer than* 33 *importations and a large number of successive outbreaks of Small-pox were successfully stamped out, and the town saved from the further spread of the disease, with its possible ravages, by the "Leicester Method" of treatment, without recourse to vaccination.*[※]

Abstracted from the Annual Reports of the Medical Officers of Health

Year	Importations of Small-pox	Small pox Cases	Small pox Deaths	Fatality per cent.	Whence imported
1874	0	0	0	0	
1875	1*	1*	1*	100*	By Tramps.
1876	0	0	0	0	
1877	1	†12	6	50	Unrecorded.
1878	2	8	1	12.5	London.
1879	0	0	0	0	
1880	1	1	0	0	By a Tramp.
1881	4	6	2	33.33	By Tramps.
1882	4	#29	5	17.24	By Tramp and others.
1883	5	12	3	25	Birmingham, evacuants of a Canal Boat & Country Dust.
1884	3	6	0	0	London, (3).
1885	4	8	0	0	Sheffield, (1) London, (2) Unrecorded, (1).
1886	1	1	0	0	Sheffield or Nottingham.
1887	2	10	0	0	Sheffield & Warwickshire.
1888	5	**22	0	0	Sheffield, (2) Tramp from the North of England, (1) other Tramps, (2).
1889	0	0	0	0	
Totals	33	116	18	mean 15.5	

Light shading Small-pox Cases.
Dark shading Small-pox Deaths.



**A child of Tramps passing through the Town died of Small-pox in 1875 but this case is not included in the deaths by the Medical Officer of Health.*

†Possibly there were 13 cases in 1877, but the information in the Health Report, is doubtful and inconclusive.

#In 1882, the Medical Officer gives 29 cases in his Report & afterwards tabulates 30 but he mentions only 28 in the Hospital Case List.

***In 1888, the Medical Officer tabulates 21 cases only but in another part of his Report he gives an additional case, making a total of 22.*

※The only Vaccinations or Re-vaccinations of Quarantined persons recorded in the Annual Reports of the Medical Officers of Health are two in 1886, and six in 1888. Some are referred to in 1887, but exact information prior to 1886 is not obtainable owing to no Register having been kept at the Fever Hospital. The total number of persons placed in Quarantine 1885-1888, was 65.- namely 10 in 1885, 2 in 1886, 14 in 1887 and 39 in 1888, since which date no Small-pox cases have either occurred or been imported into the Town.

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(Papers handed in by Mr. John Thomas Biggs.)

DIAGRAM E. *illustrating Table II.*

This Diagram shows, (1) *The average annual Small-pox deaths per million population in successive quinquennial periods from* 1838 *to* 1889.

(2) *A great rise in Small-pox mortality coincident not only with the more stringent enforcement of vaccination, but also with the consequent accumulation from* 1849 *of its alleged "protective" power.*

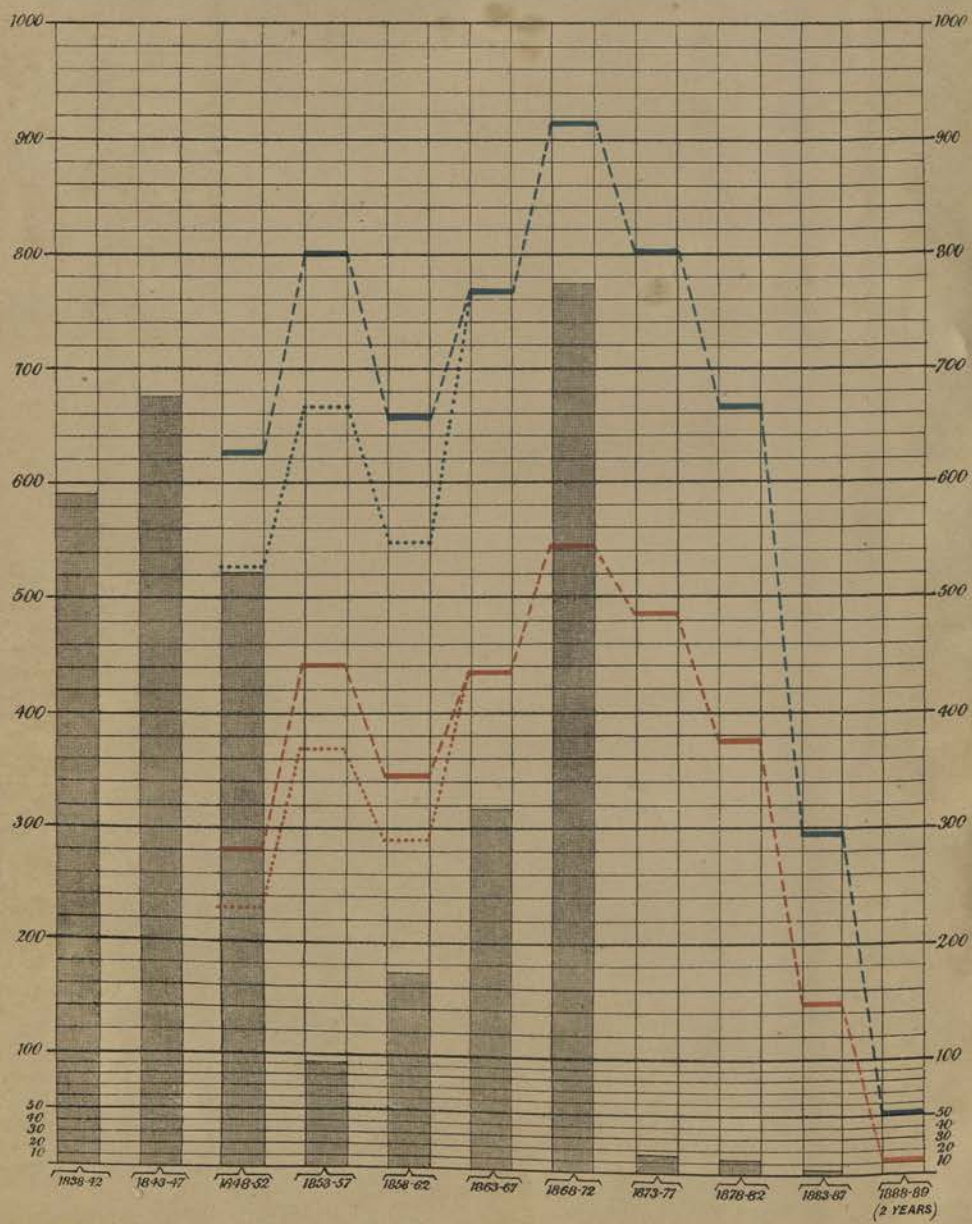
(3) *The general abandonment of vaccination by the Leicester people when Small-pox mortality rapidly disappears.*

Black columns — *Small-pox death-rate per million.*

Blue curve — *Average annual registered vaccinations to* 1000 *births.*

Red curve — *Accumulated vaccinations per* 100,000 *population for five years, ending with the last year of each period. (Three per cent. only shewn to suit the compass of the diagram.)*

(The space between solid and dotted curves shows the addition for private vaccinations, 1849-62.)



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(Papers handed in by Mr John Thomas Biggs.)

DIAGRAM F. *illustrating Table 12.*

This diagram shows, (1) *The average annual Small pox death-rate per million population in successive quinquennia since the earliest year of obtainable official vaccinations* (1849);

(2) *After more than* 20 *years of continuous vaccination a great increase of Small-pox mortality, which culminates in the unprecedented fatality of* 1868-72, *when vaccination reached its highest point;*

(3) *Subsequent to* 1872 *a rapid decline in vaccination until it was practically abandoned, and an equally marked increase in Sanitation, &c., when Small-pox mortality also rapidly declines and becomes extinct.*

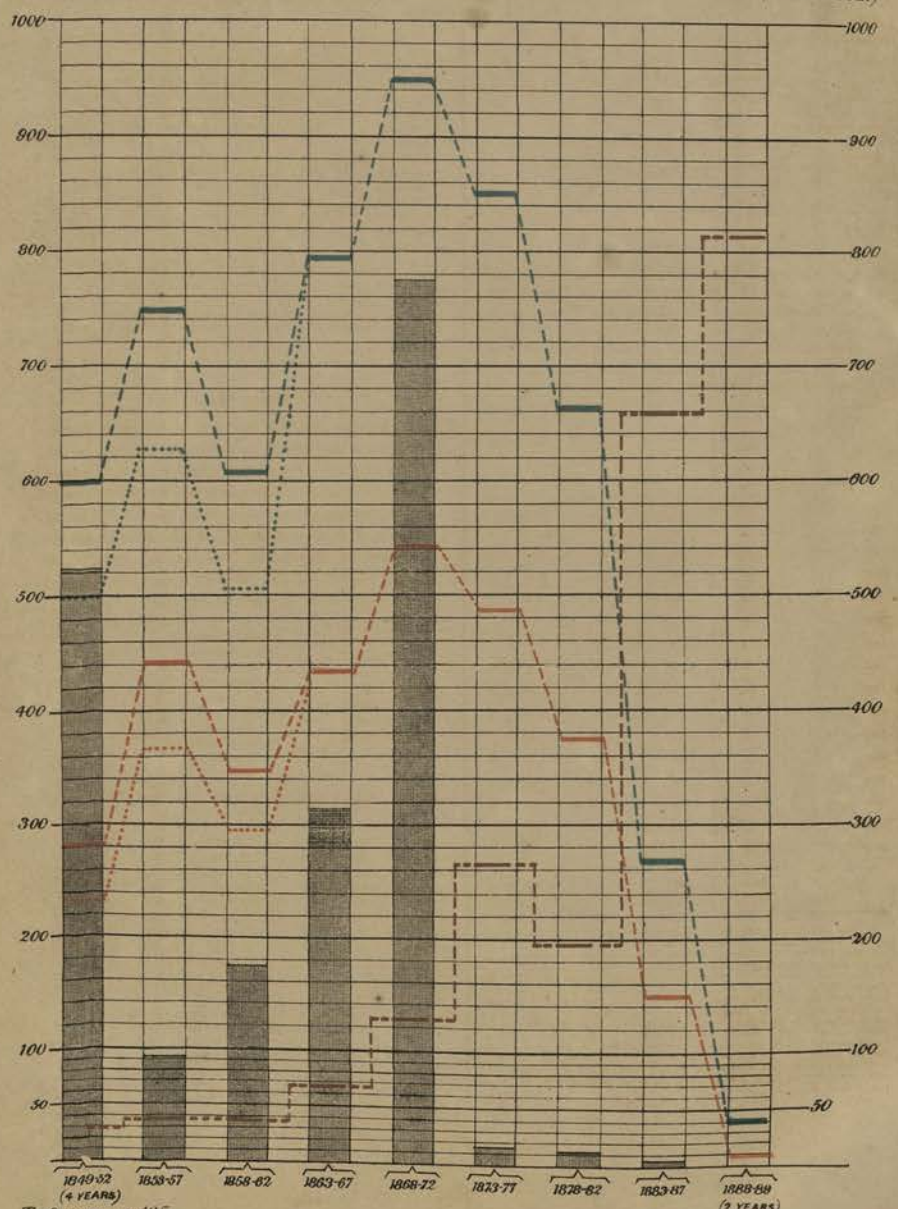
Black columns — *Small-pox deaths per million.*

Blue curve — *Average annual registered vaccinations per* 25,000 *population.*

Red curve — *Accumulated vaccinations per* 100,000 *population for* 5 *years ending with the last year of each period. (Three per cent. only shewn to suit the compass of the diagram.)*

Brown curve — *Average Annual number of sanitary orders to abate nuisances* (10 *per cent. only shown on diagram.*)

(The space between solid and dotted curves shows the addition for private vaccinations, 1849-1862.)



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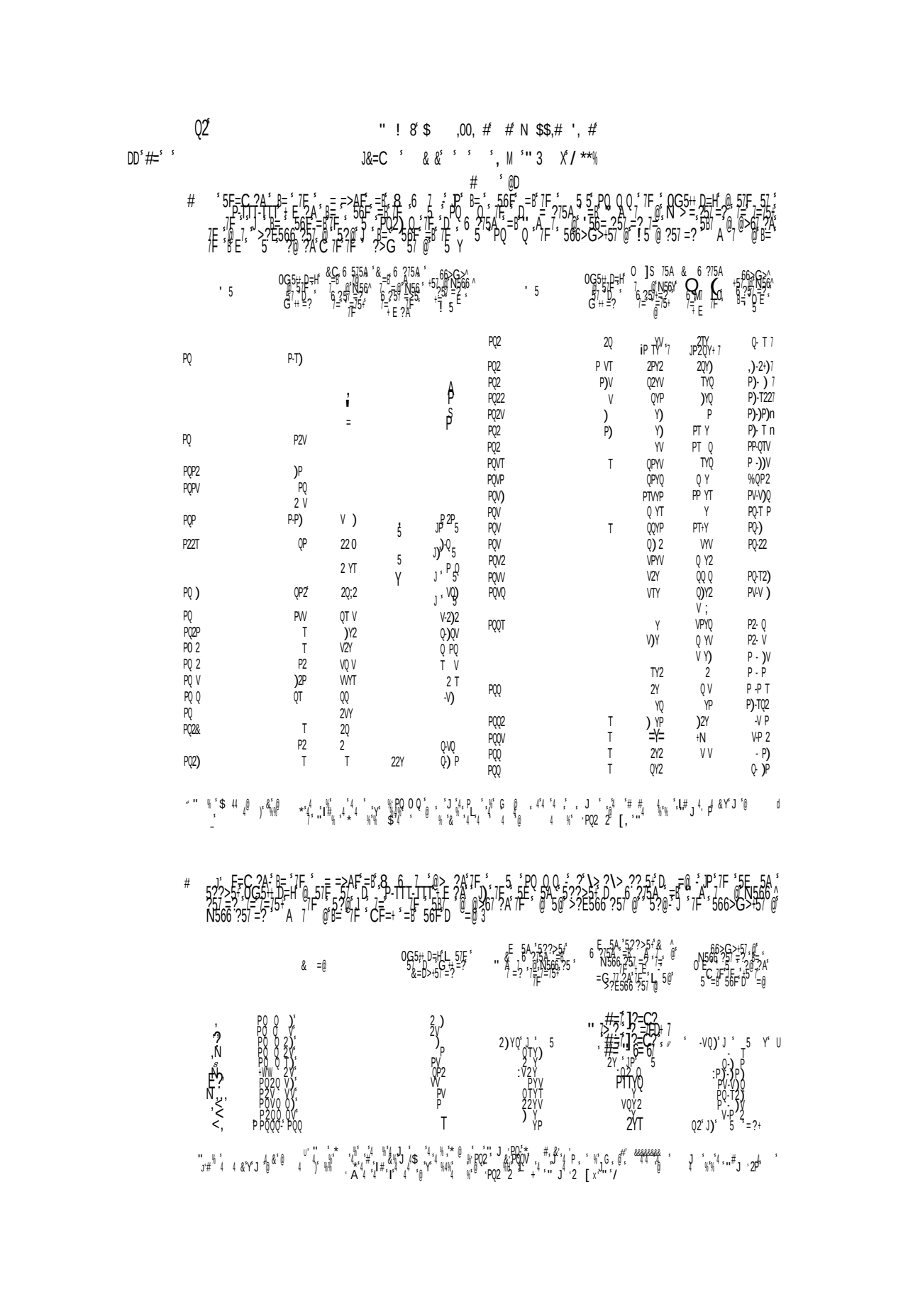

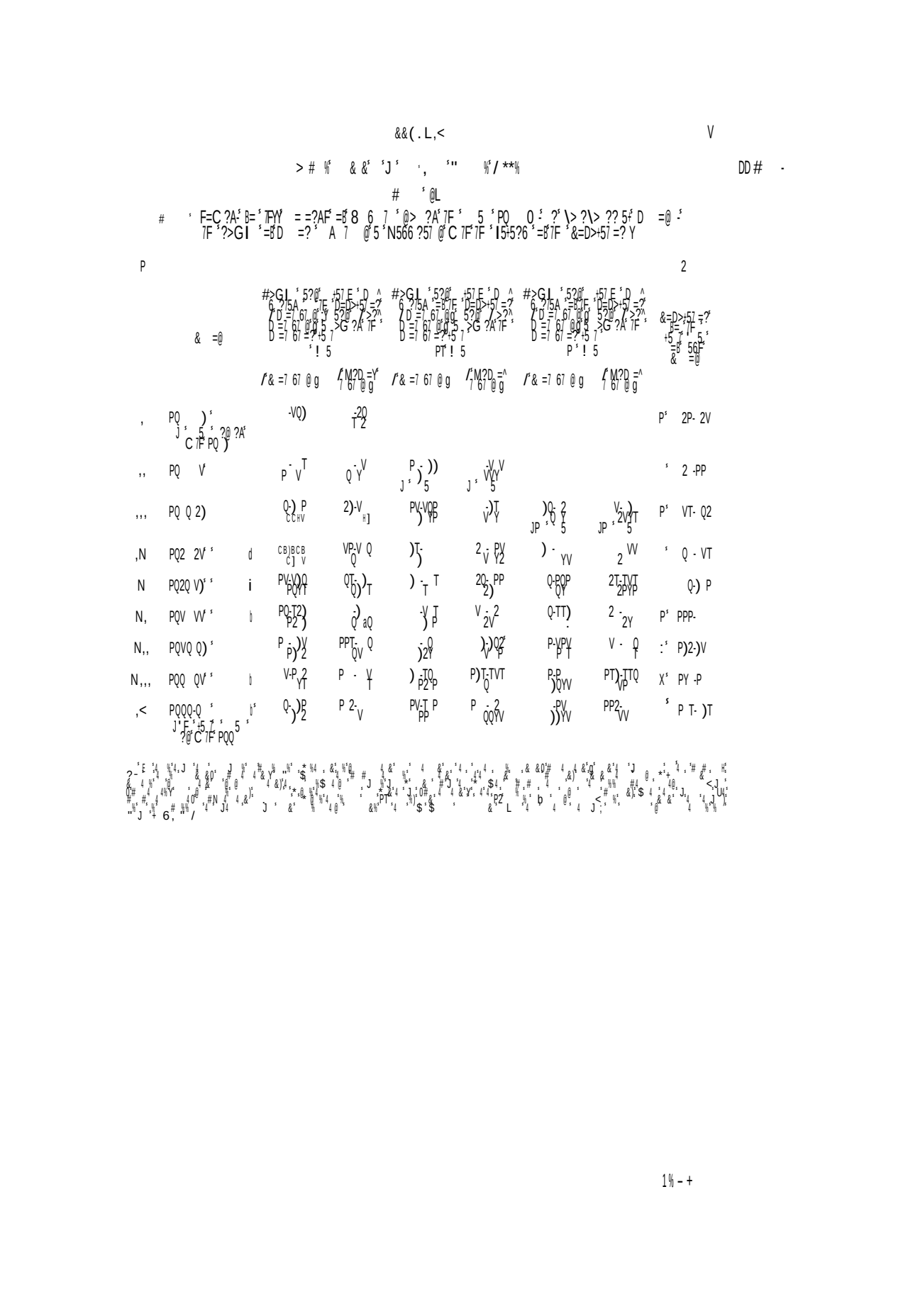

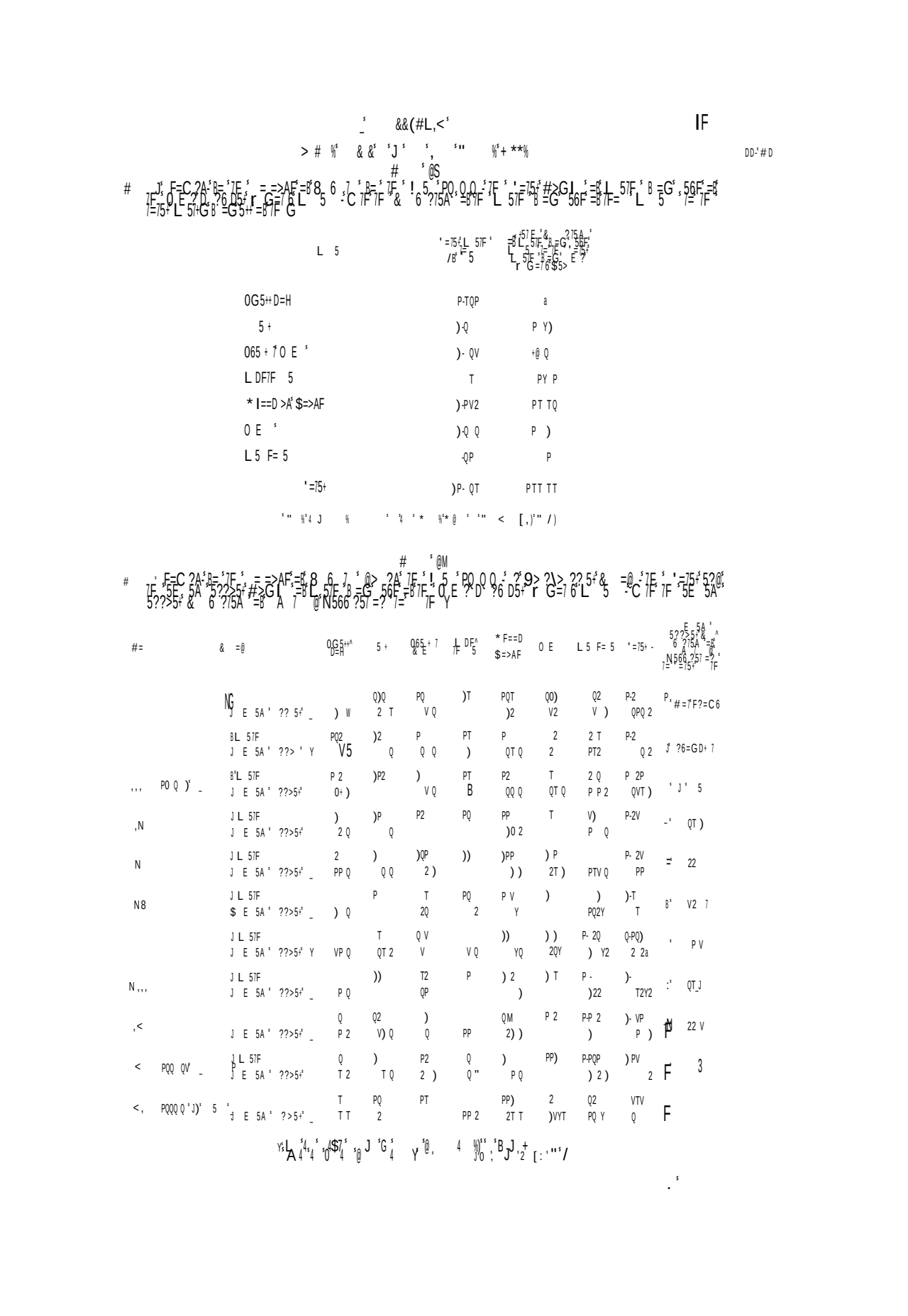

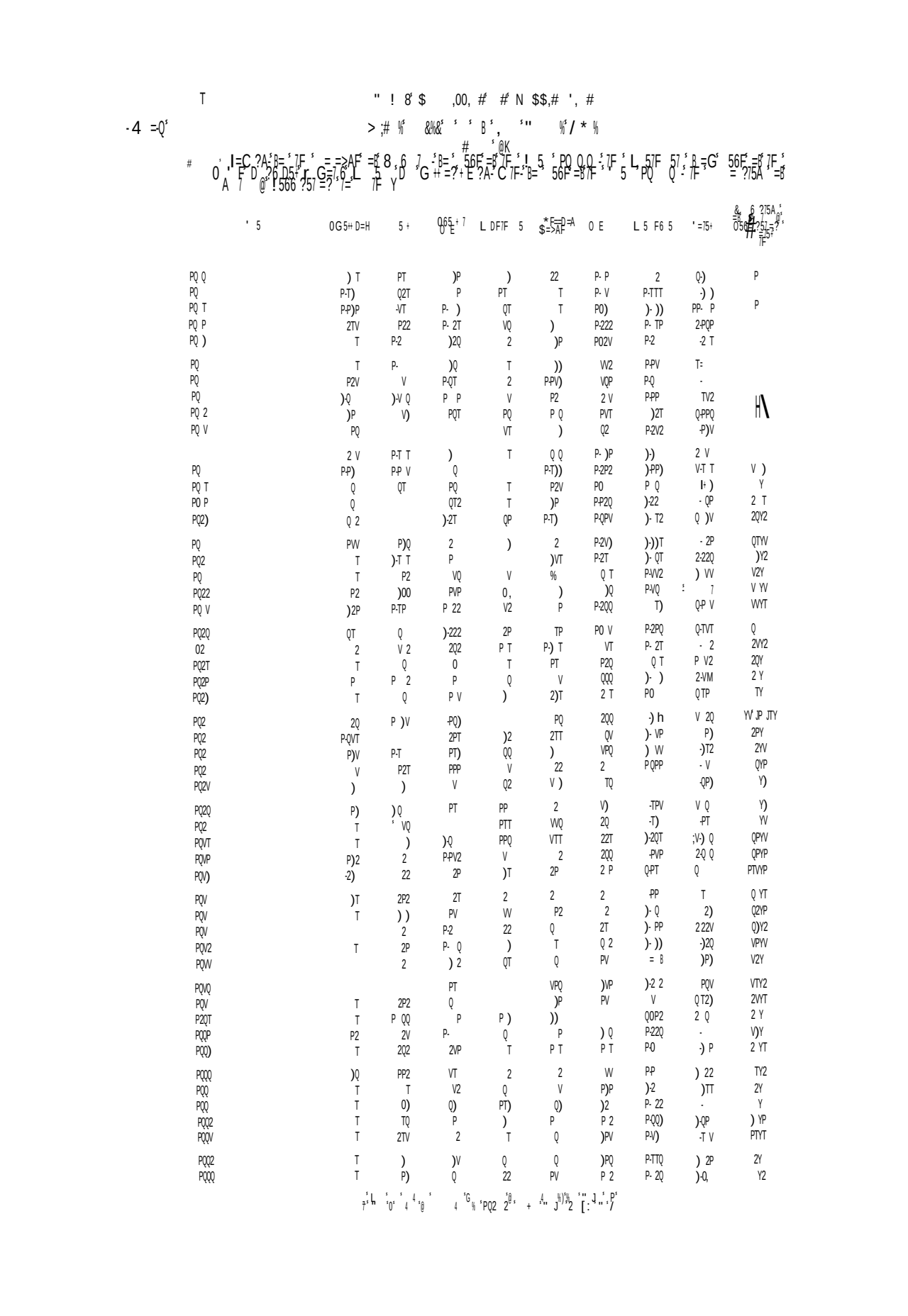

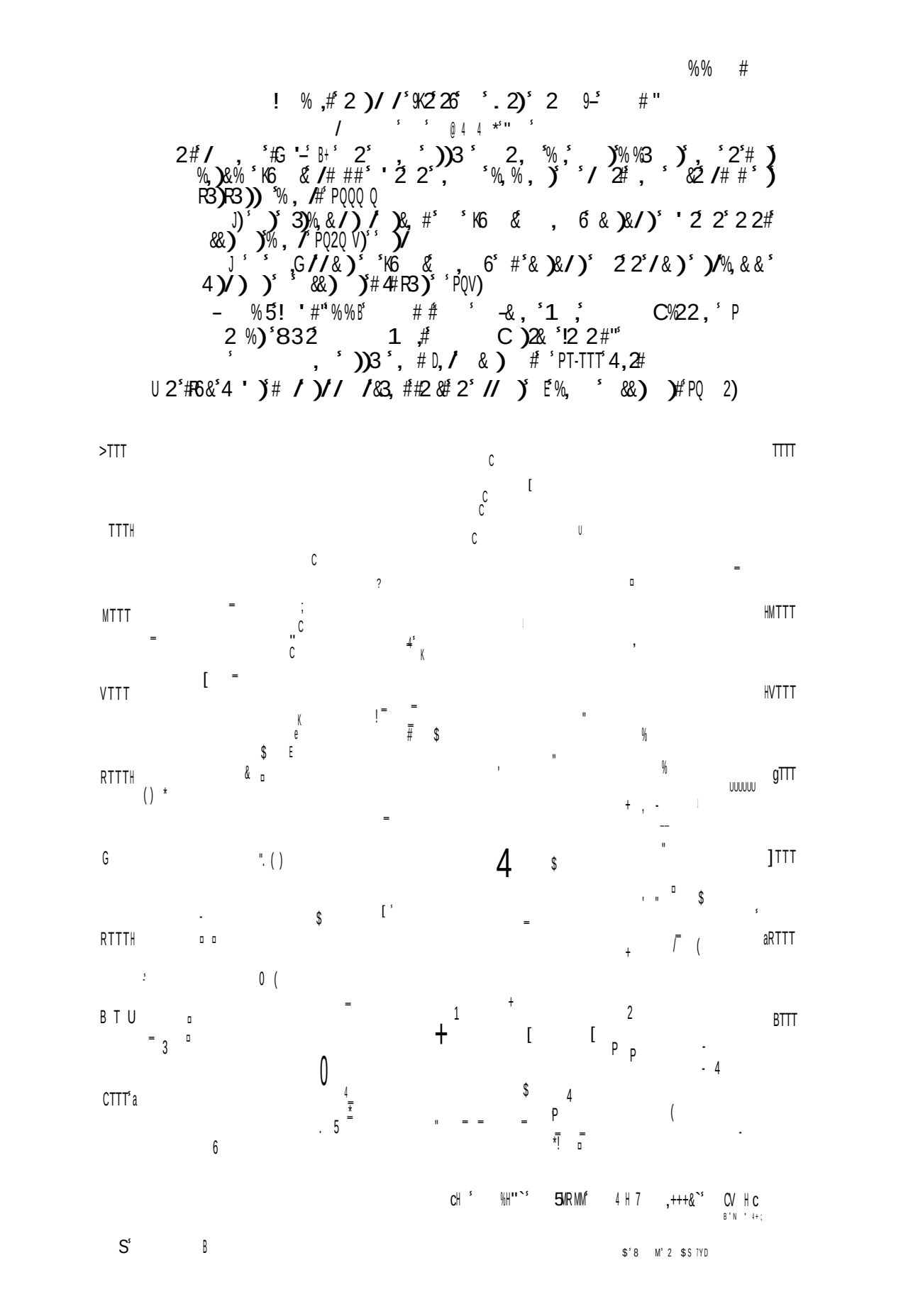

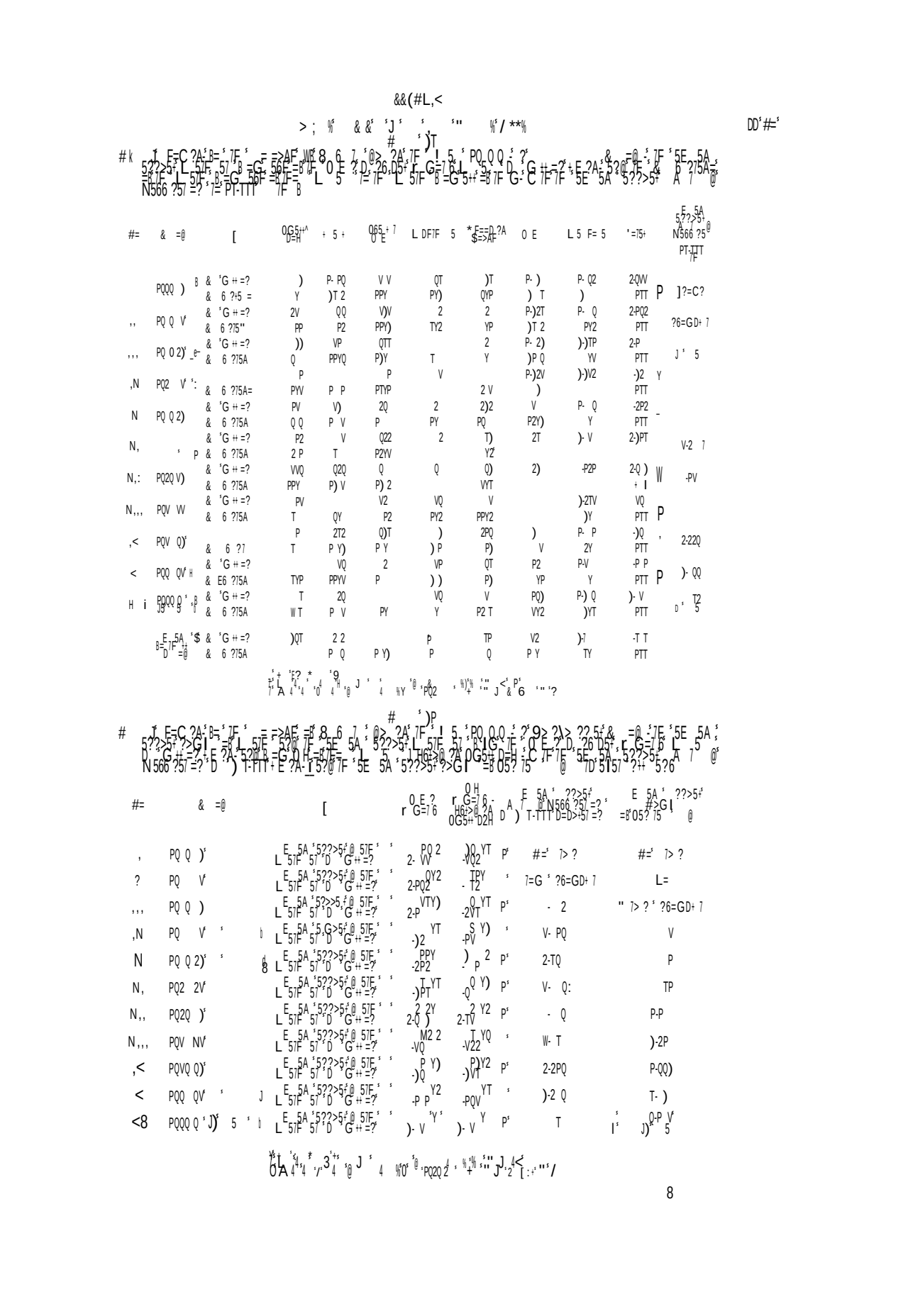

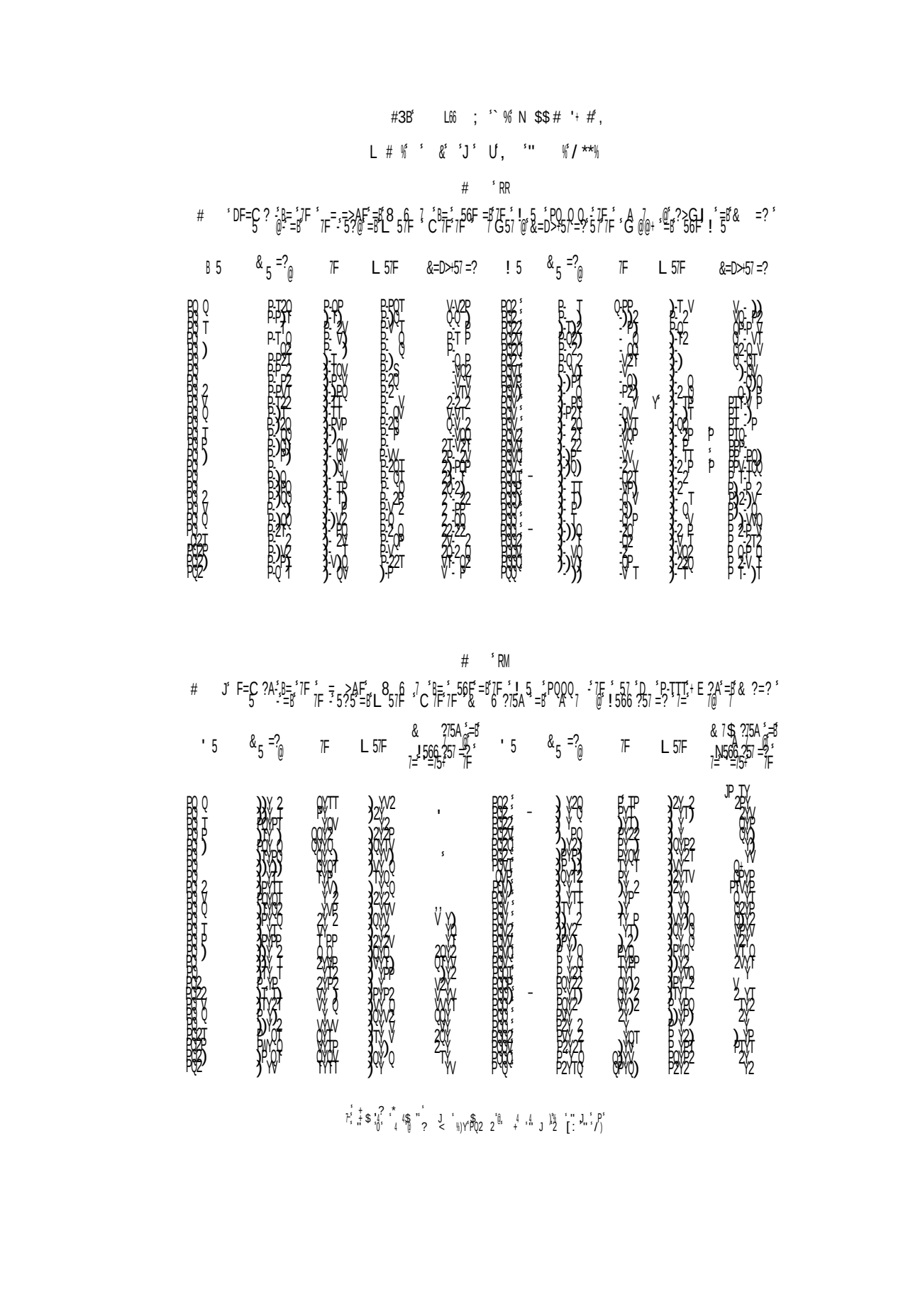

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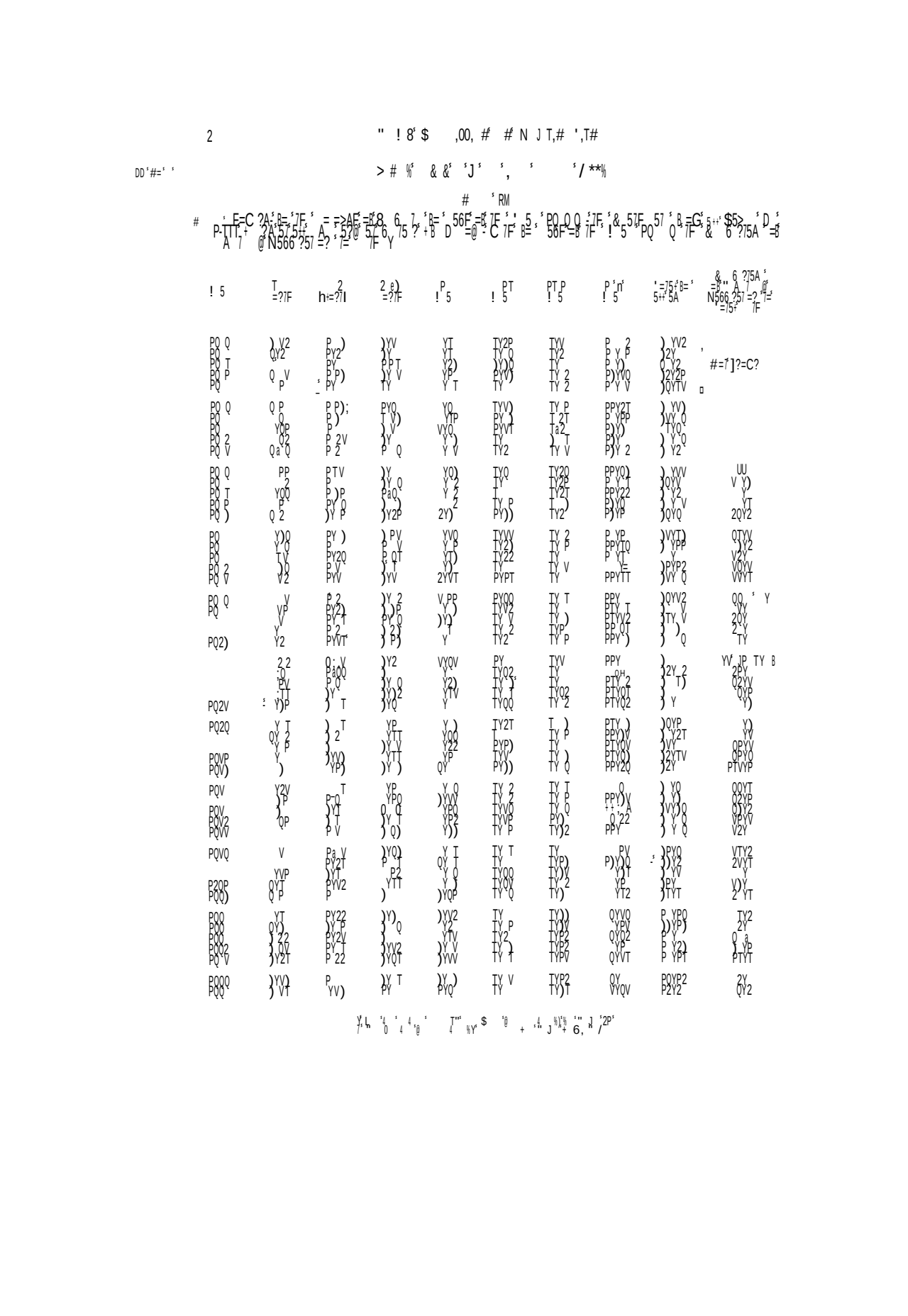

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N,,	PQ2Q V)		) 2V	))	VP	T Q)	T	PT)	)2 Q)	P V
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PQ V	)T)	) Q	PT	2 Q	2	V))	P- V
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PQ)	))V	2	)	P	QQ	P-T V	P-VV
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PO22	)	P	VTT	Q	QQ	P-TPV	P-Q
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POVP	P2	2VV	2	P- 2P	P- T	P- 2T	)- Q
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POV	Q	2	2	P-))	P- T	P-	)-)T
POV		2VT	P-T	P- Q	P-22	P-VP	)-QQ
POV2	P	2)	2	P- TQ	P- Q	P-2)T	)- 2P
PQVV	Q	Q	Q V	P-)	P- P)	P- P	)- P
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POQT	V	2 T	P-TVT	P-V)V	P-Q	P-Q22	)- 2
POQP	QT	2	2	P- V	P- Q)	P- TV	)-2
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P TTTˢ ˢE ?Aˢ 57 5+ˢ5?@ >?@ 6 ?5 ?ˢ Aˢ ˢ C ?Fˢ Bˢ= 56Fˢ=Bˢ ?Fˢ ! ˢ5 ˢPQ ˢQ 57F & 6 ?75A ˢ=Bˢ A ? @ˢ
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7□	□Q□	CQ 7H	H&8H	H&C7	7Q7H	8&□	G□QHG	
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7□H	□&7H	HQCG	7Q8	GQ □	□Q 8	HQ□8	8&□7	
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7 C	□& G	CQC	6&8G	Q78	Q7	G&8	C&C6	CG&
7C	GQH8	H&	7ˢH	□Q7C	HQ 6	HQ6	Ú 7Q7□	H7&H
7CG	□& 7	CQH	6&66	& CC	G&G	G&77	6Q	7 Q6
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7C7	GQC6	C&	6QH7	□Q68	H&H6	6& 6	7Q6H	7MQ
7C8	G&6	C§GG	6QC□	&8H	7Q6	□& 6	□QC6	C6QC
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7HG	G&HH	C&7G	7Q□H	HQGG	6Q6H	7&C	8Q8C	C□Q6D □ □[
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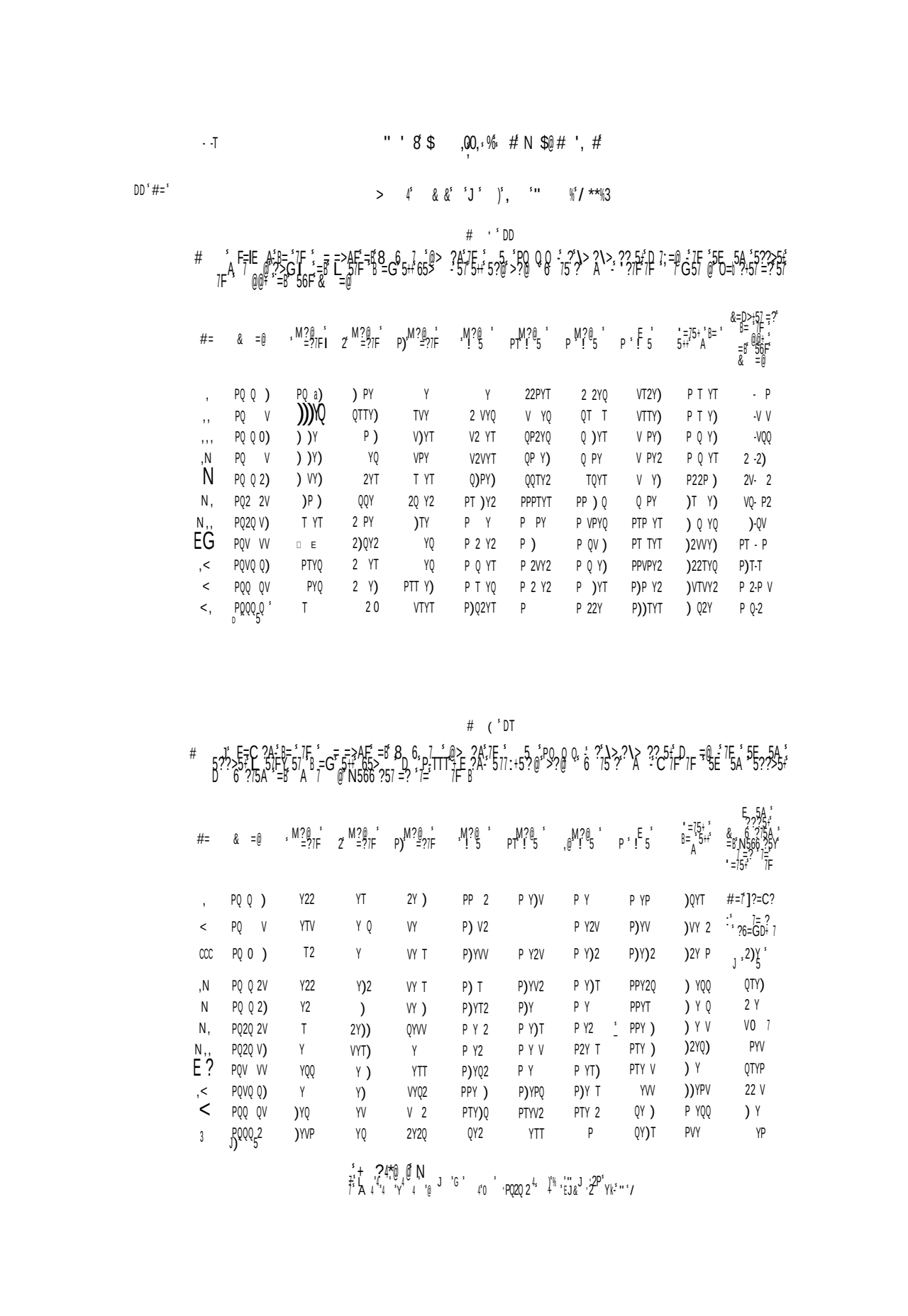


(Papers handed in by Mr. John Thomas Biggs.)

DIAGRAM M. *illustrating Table 34.*

This diagram shows, (1) *The average annual death-rate from all causes per* 1000 *total population, with the relative proportion of death rates at each enumerated age (in separate colours, exclusively) in quinquennial periods,* 1838-89.

(2) *The total death-rates under each age, inclusive, measuring from the base line of the diagram to the upper edge of each colour;*

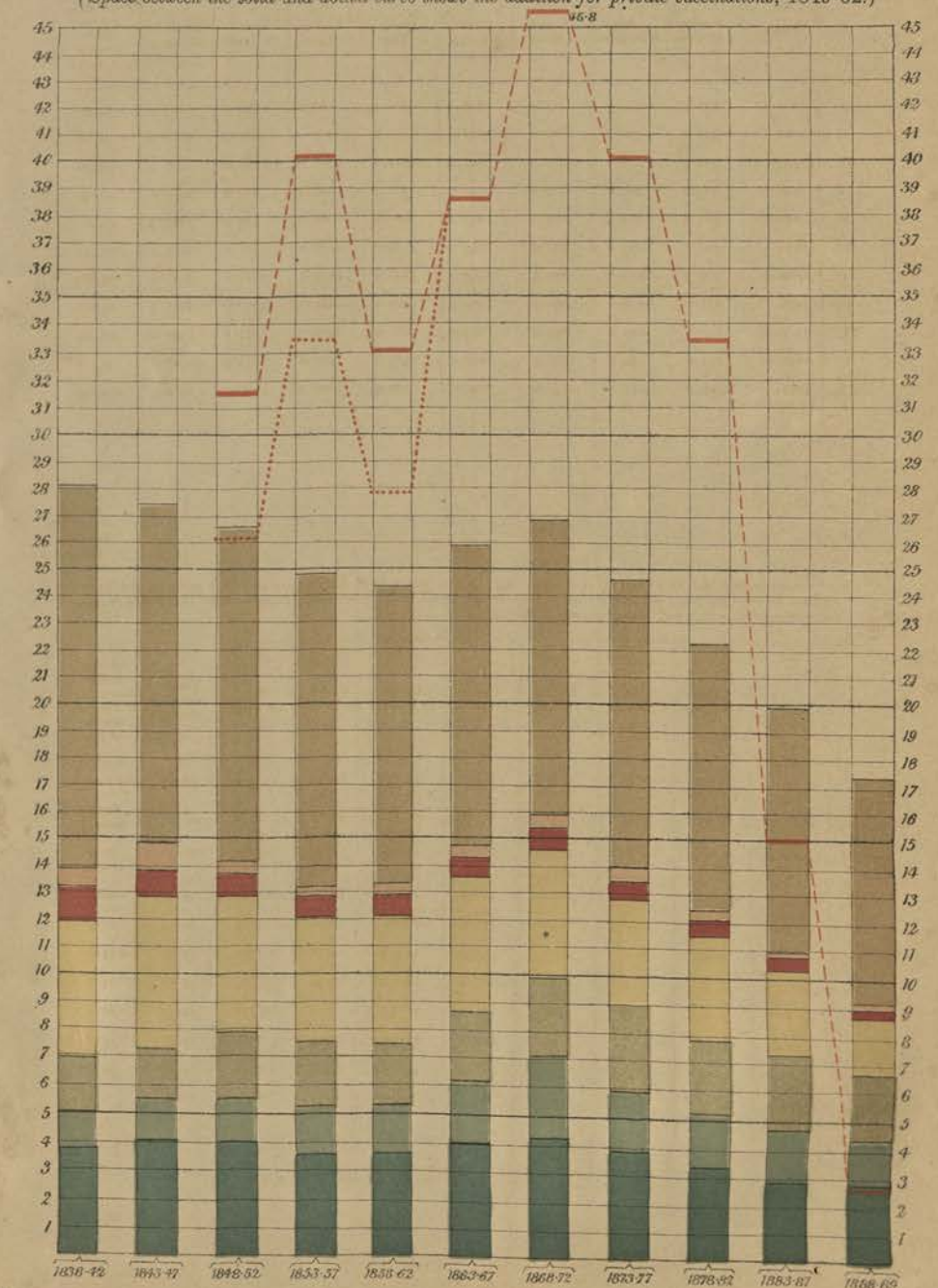
(3) *That the decline in the death-rate (due to sanitary improvements) is checked, and a considerable increase of the death-rate corresponds with the period of more rigorous enforcement of vaccination,* 1868-72; *and,*

(4) *An emphatic decline in the general death-rate, and especially in the younger ages, as the practice of vaccination declines.*

Deaths under 3 months. *Deaths 3 to 6 months.* *Deaths 6 to 12 months.* *Deaths 1 to 5 years.*
Deaths 5 to 10 years. *Deaths 10 to 15 years.* *Deaths over 15 years.*

Average annual percentage of registered vaccinations to total births (50 *per cent. only shewn to suit compass of the diagram.*)

(Space between the solid and dotted curve shows the addition for private vaccinations, 1849-62.)



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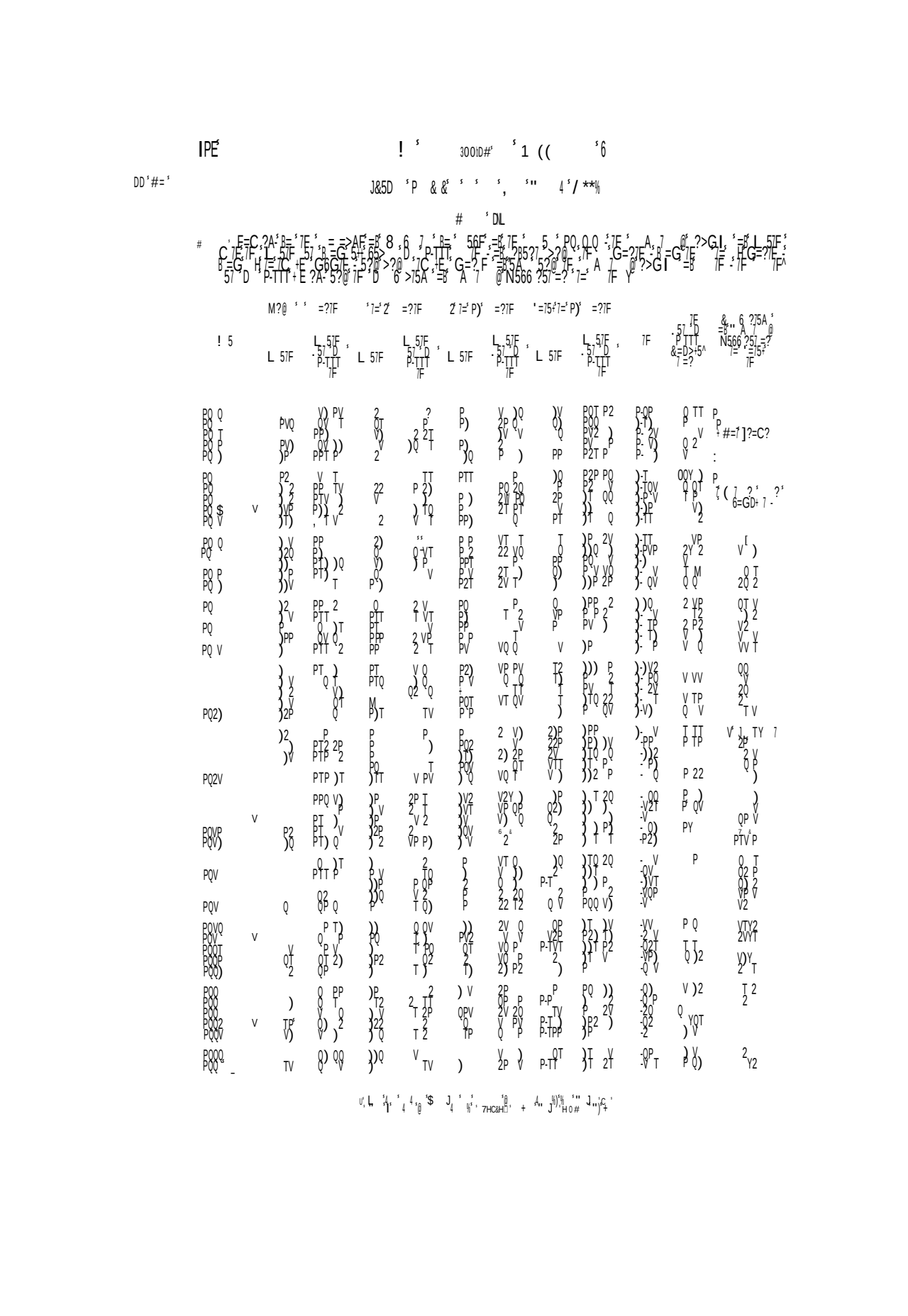

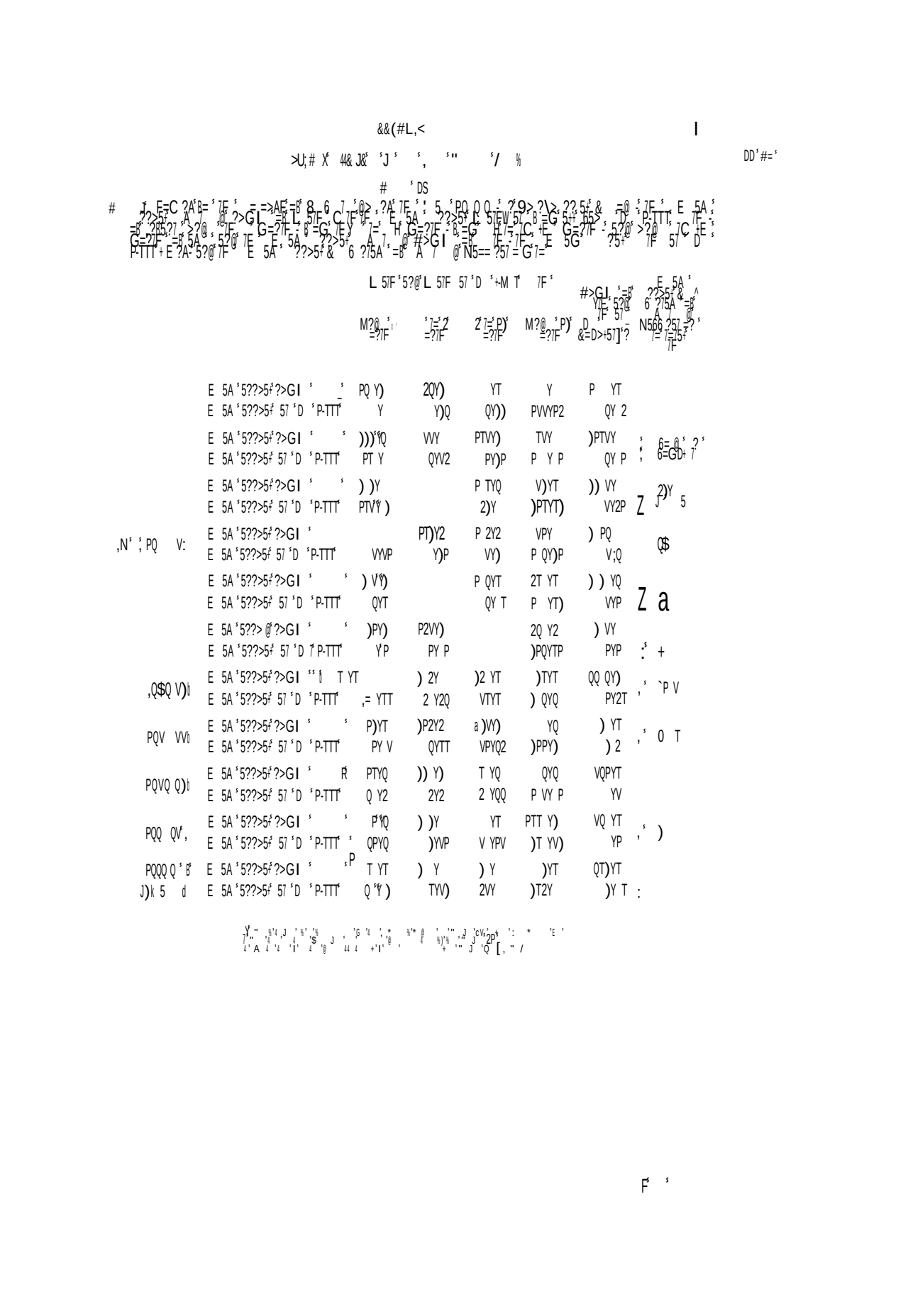

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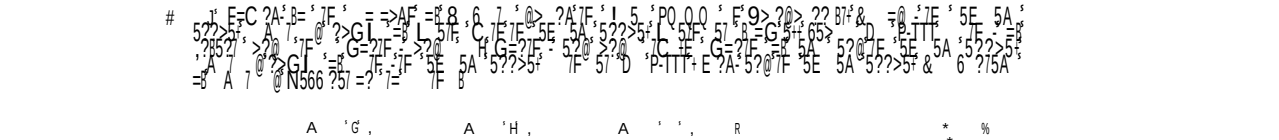

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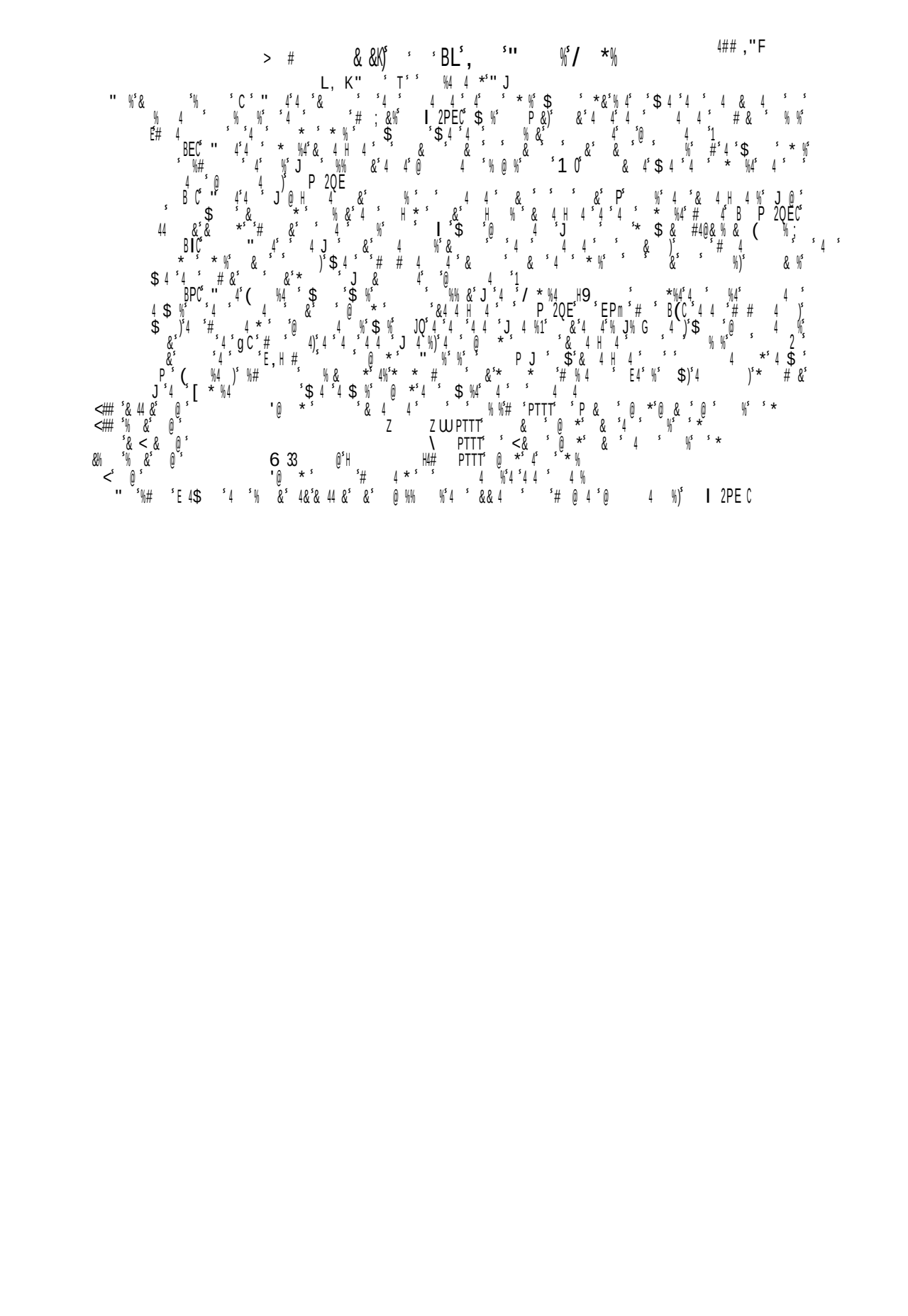

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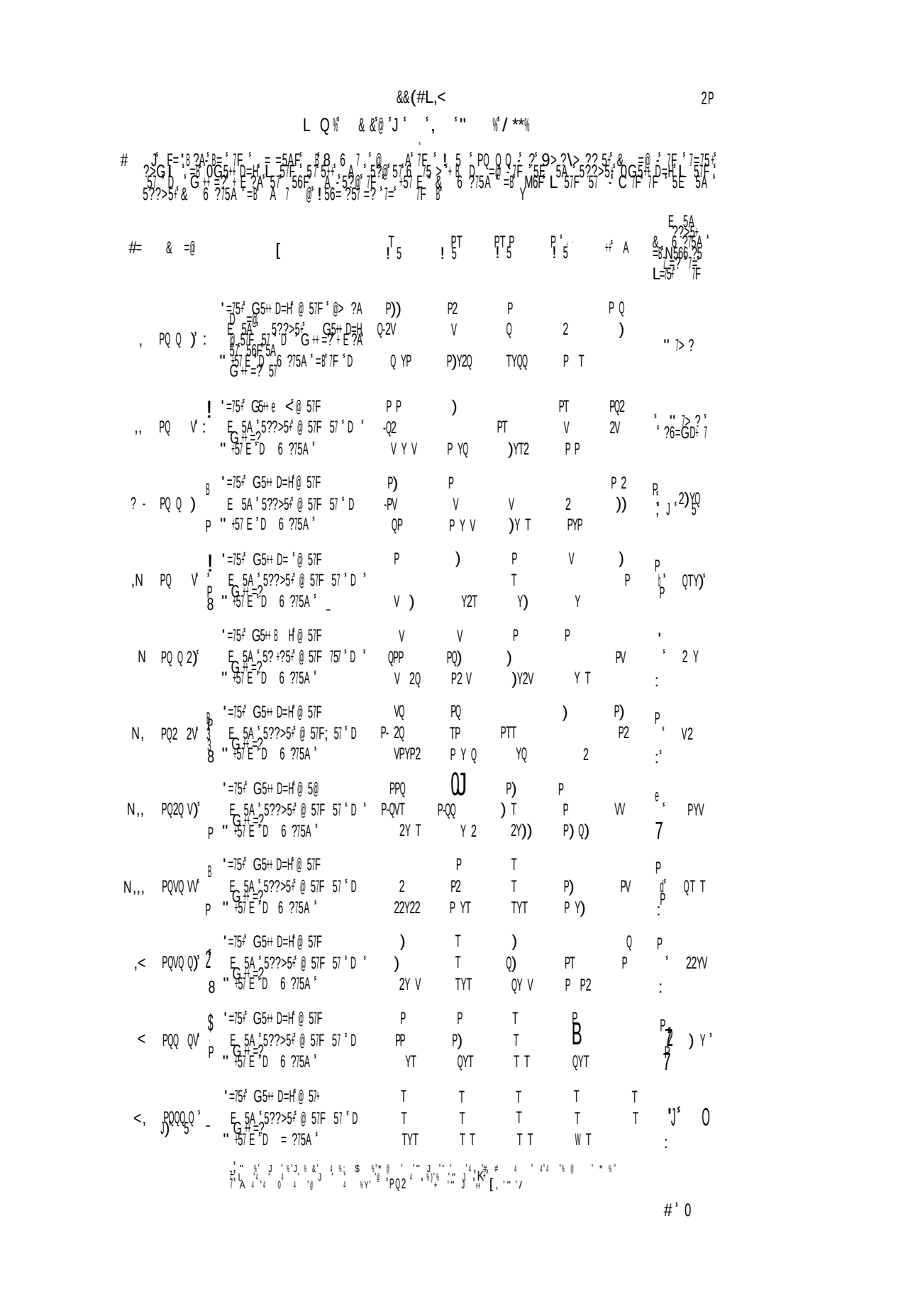

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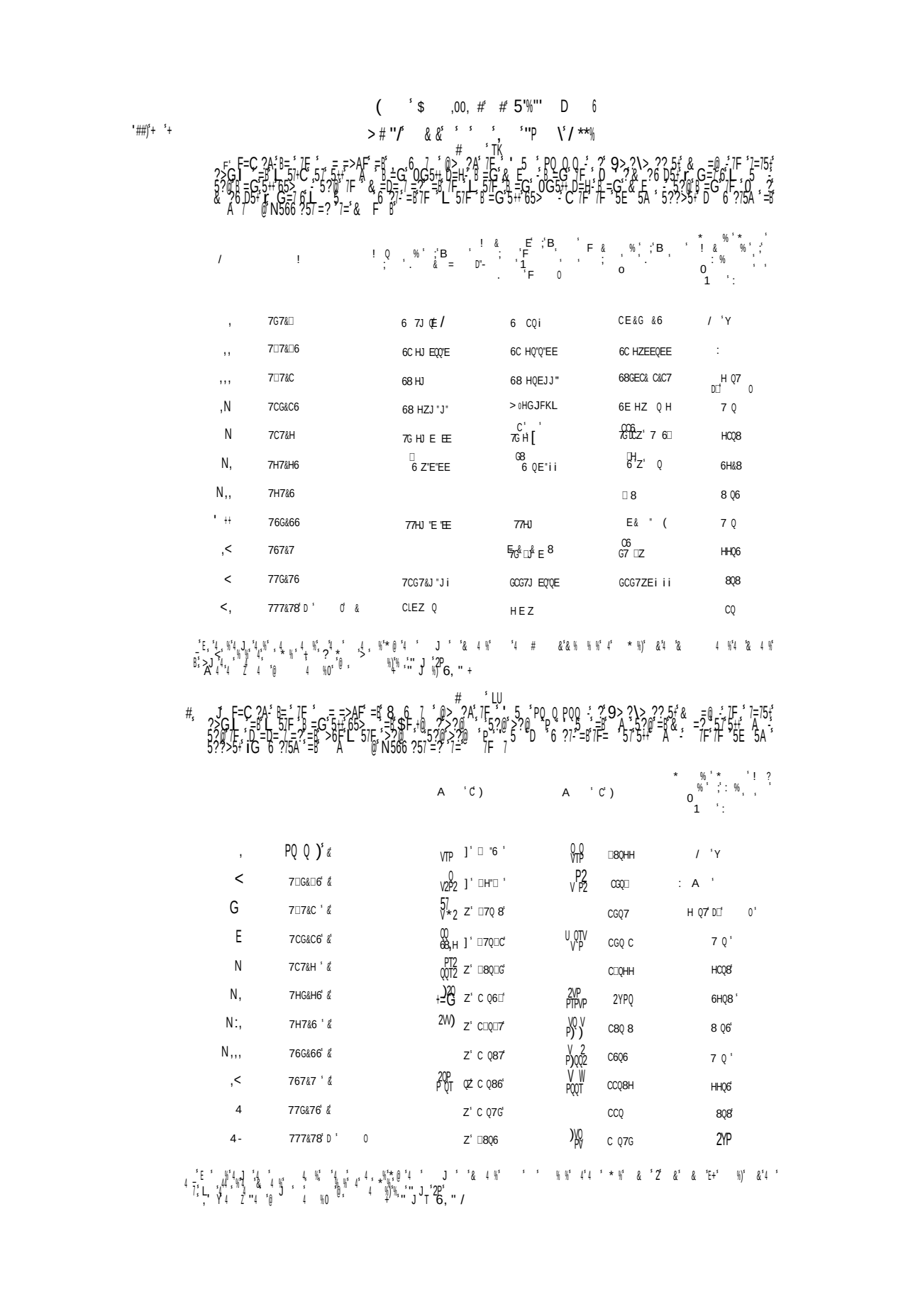

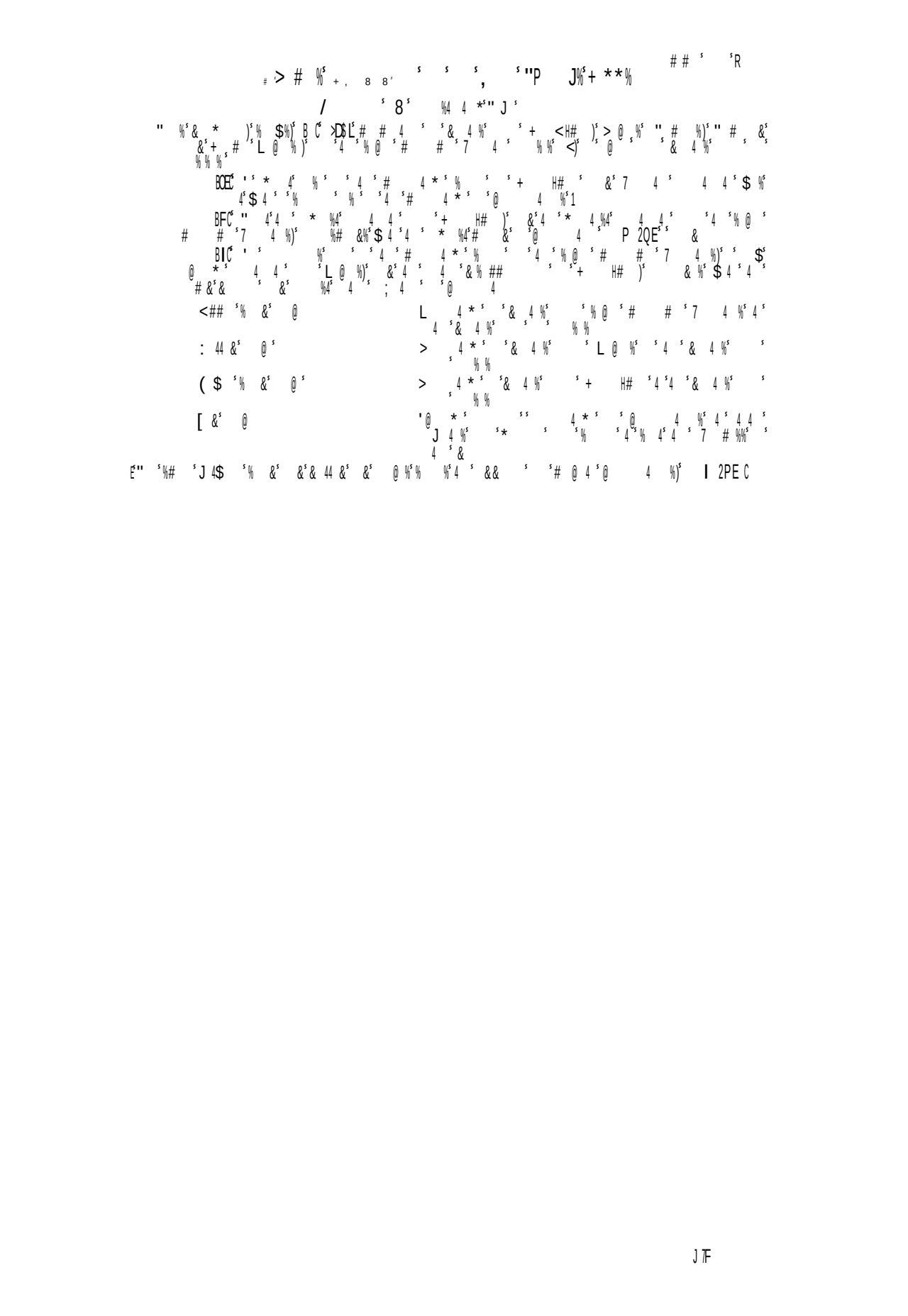

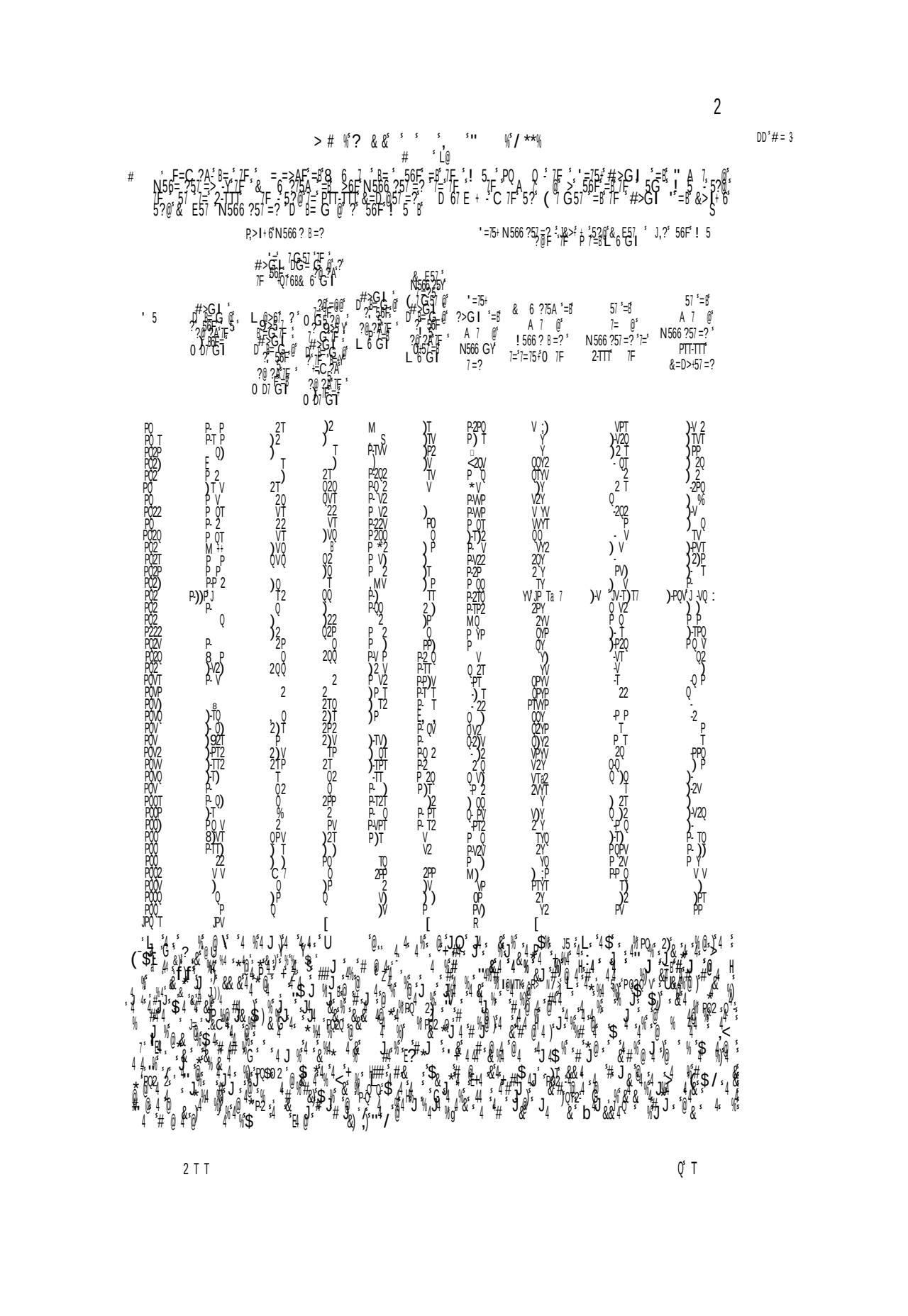

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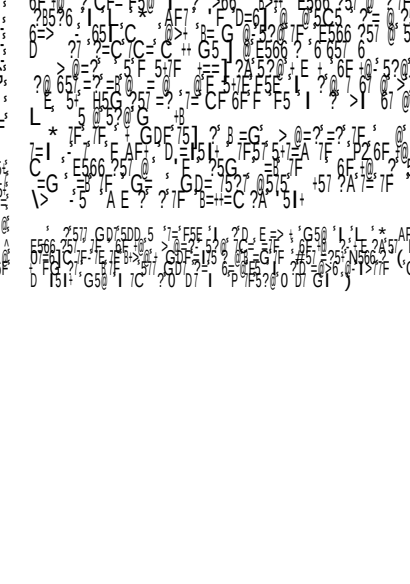

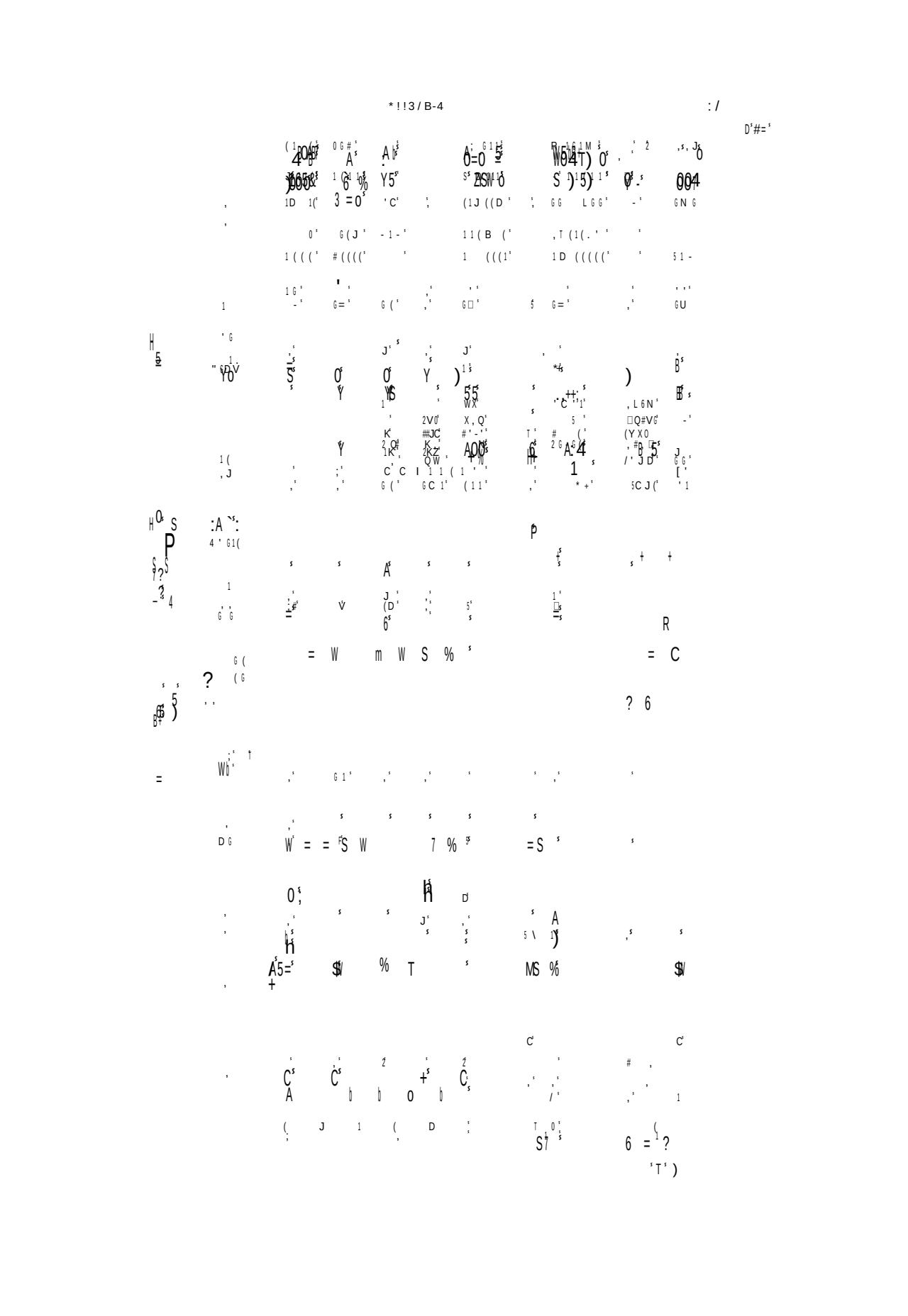

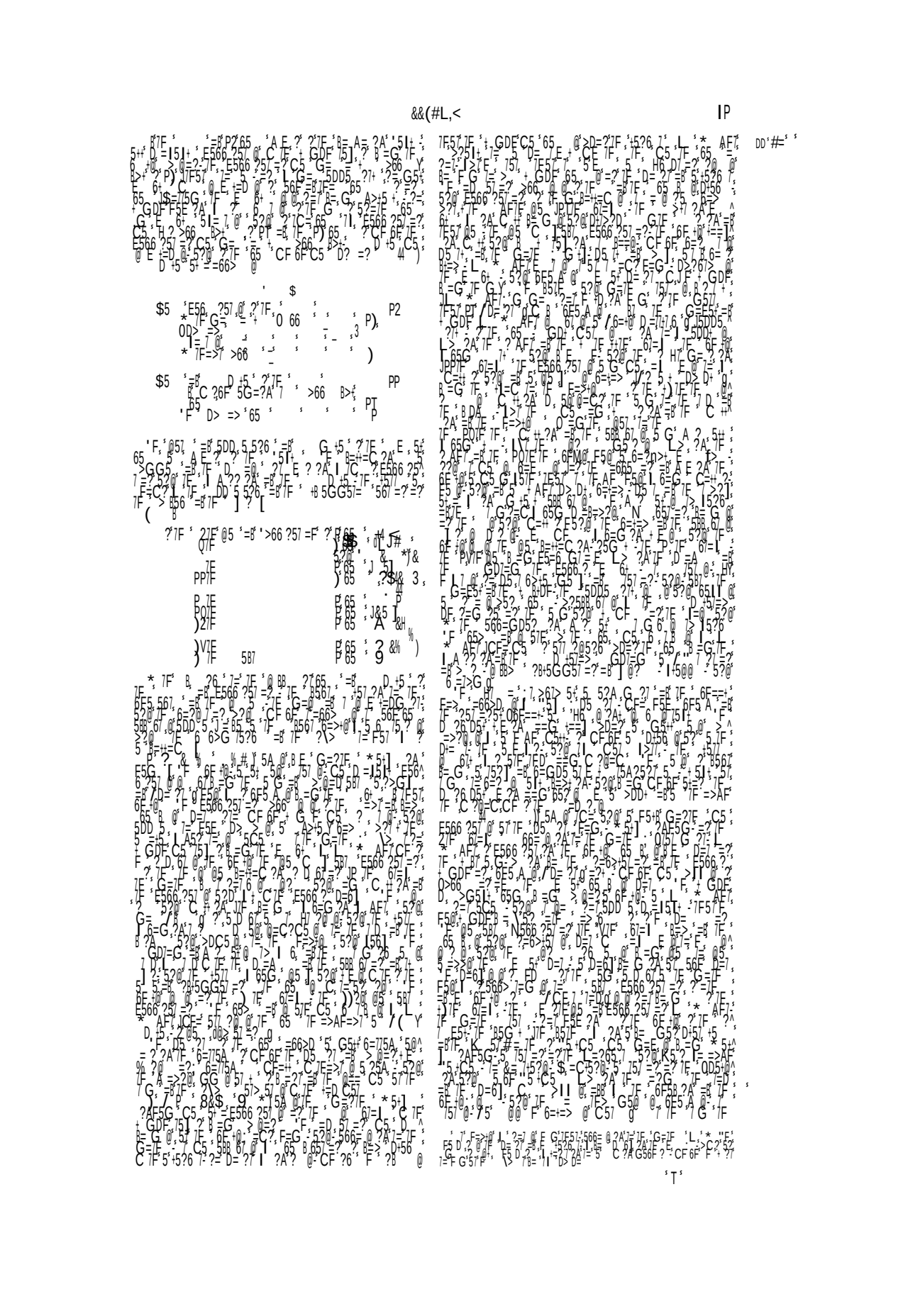

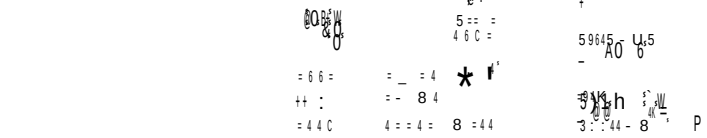

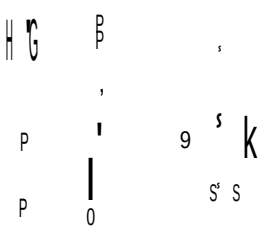

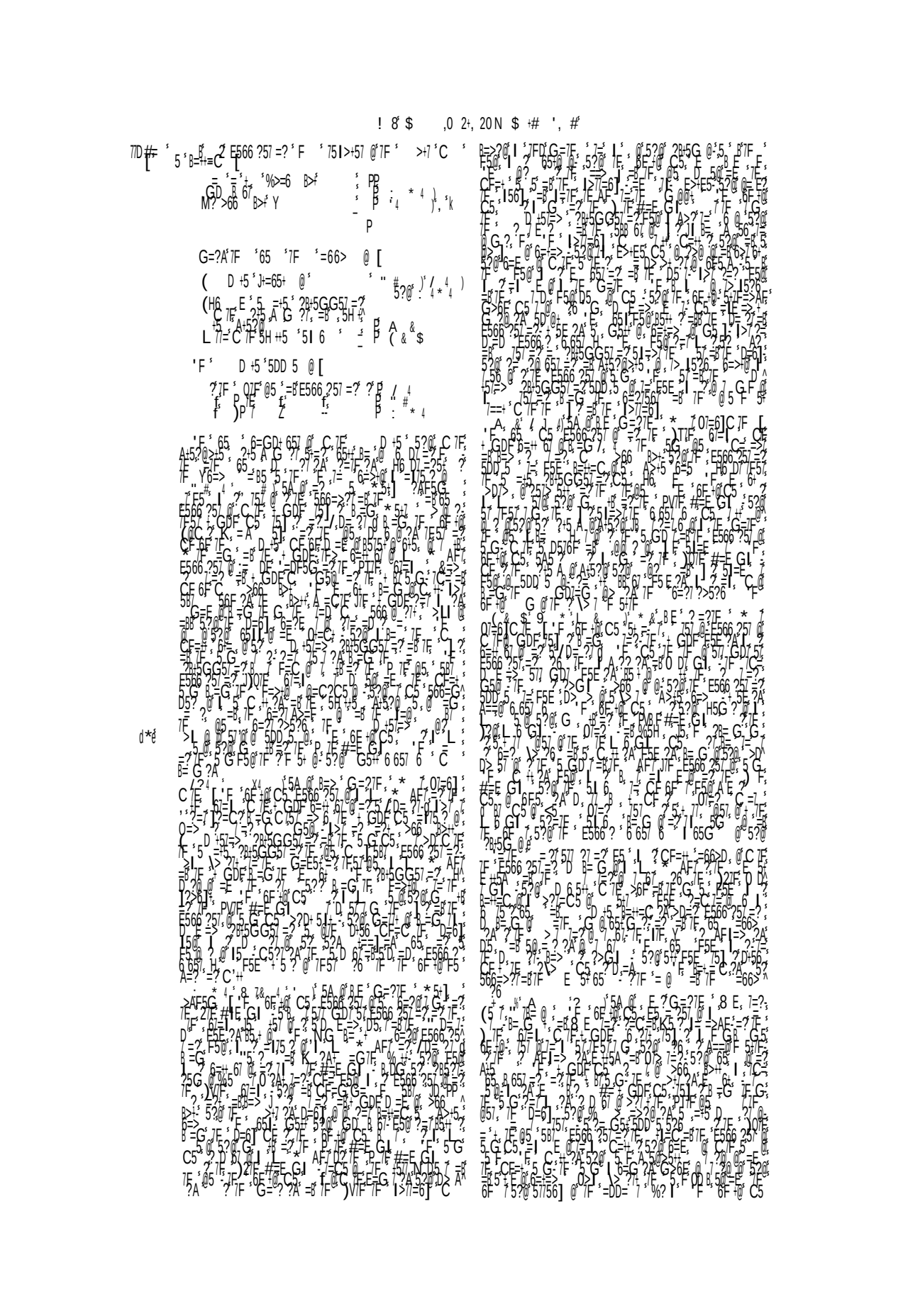

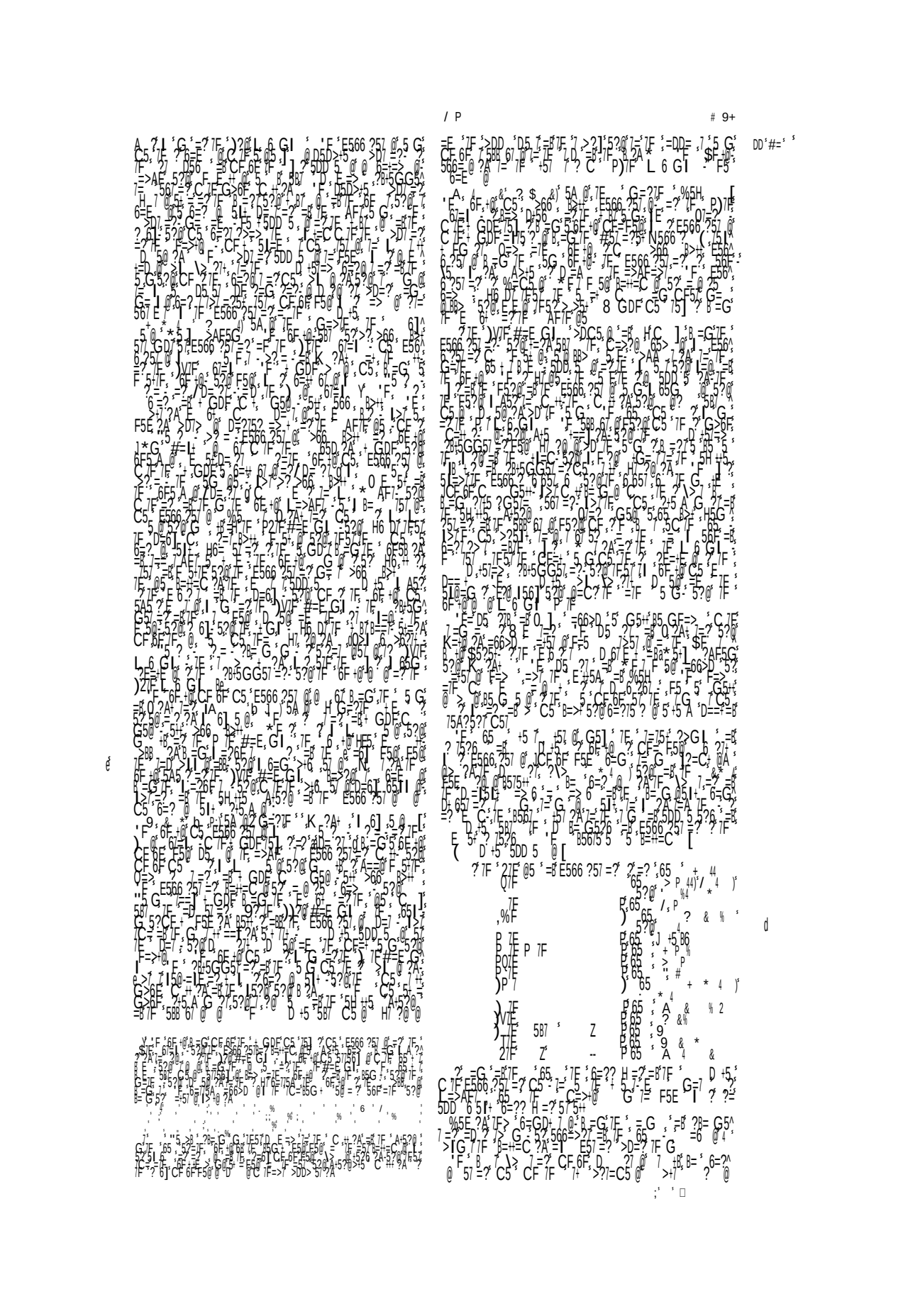

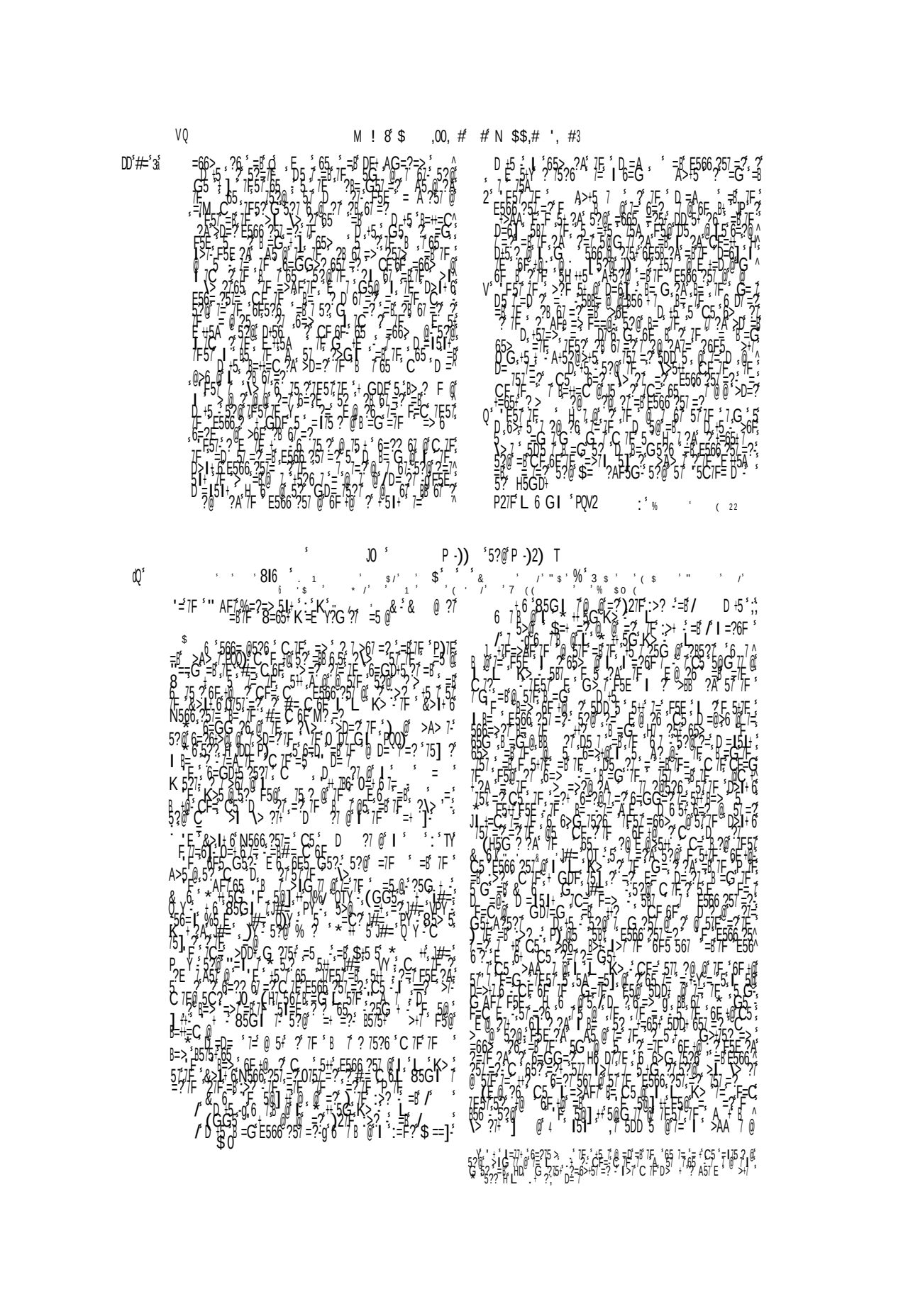

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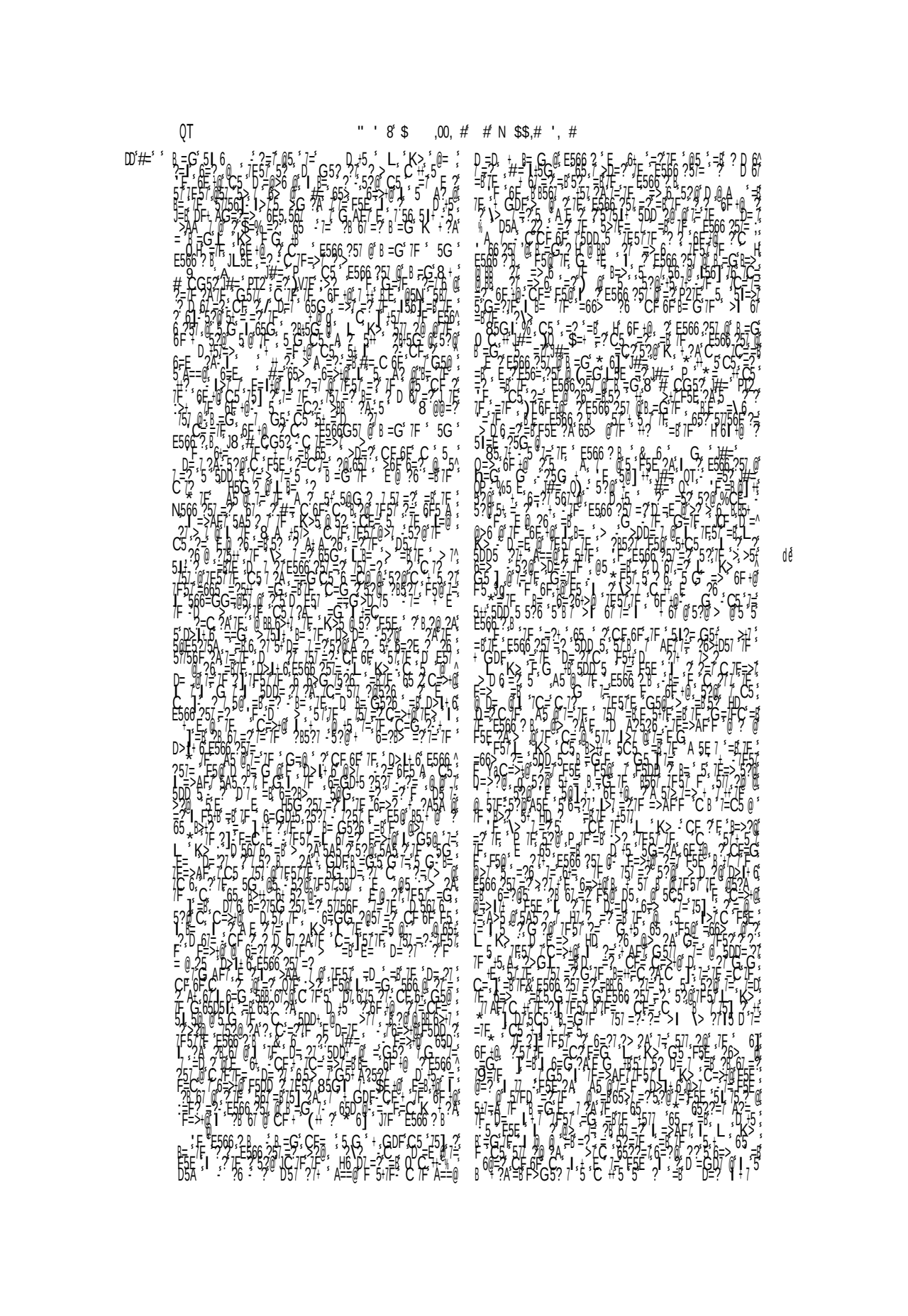

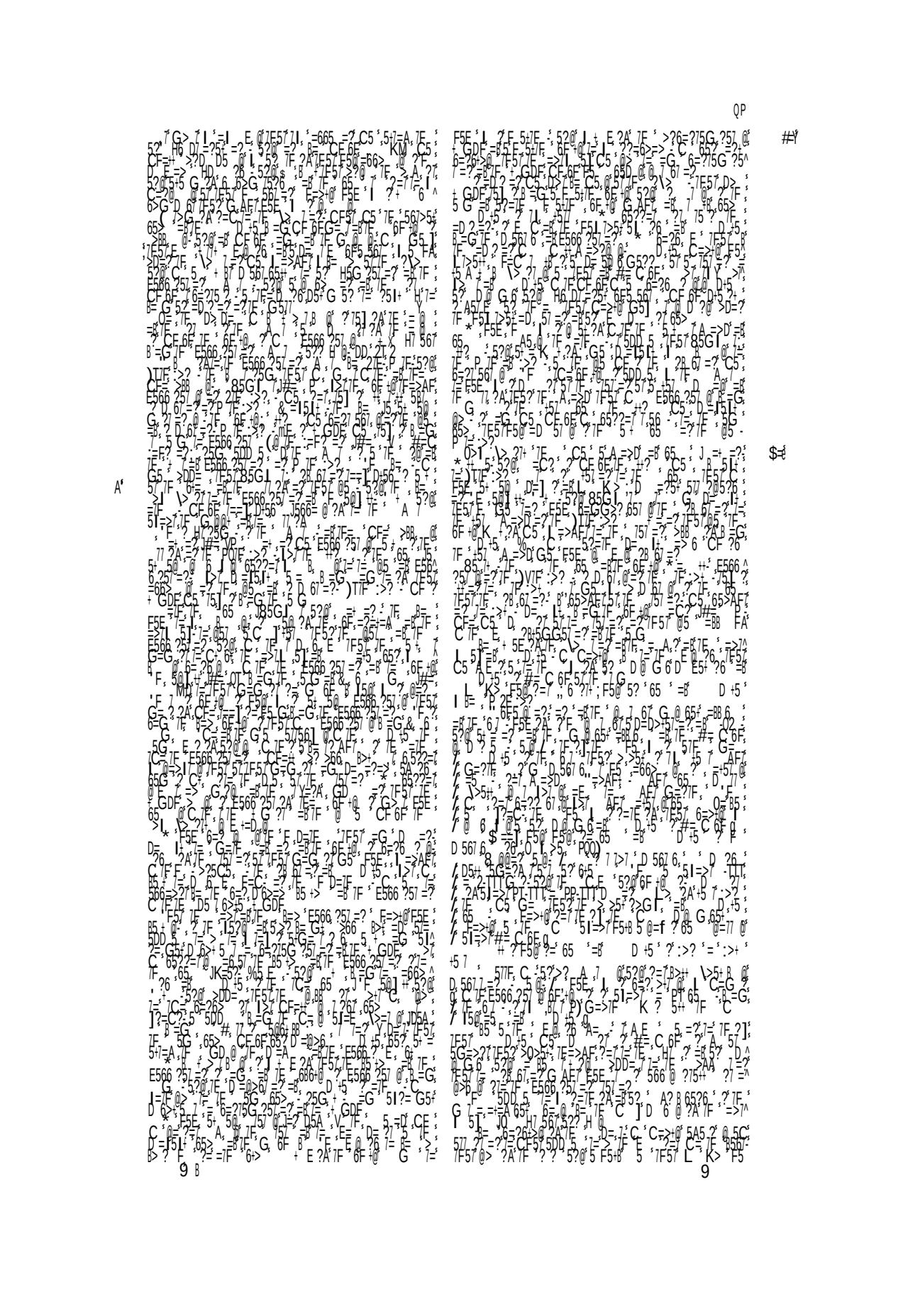

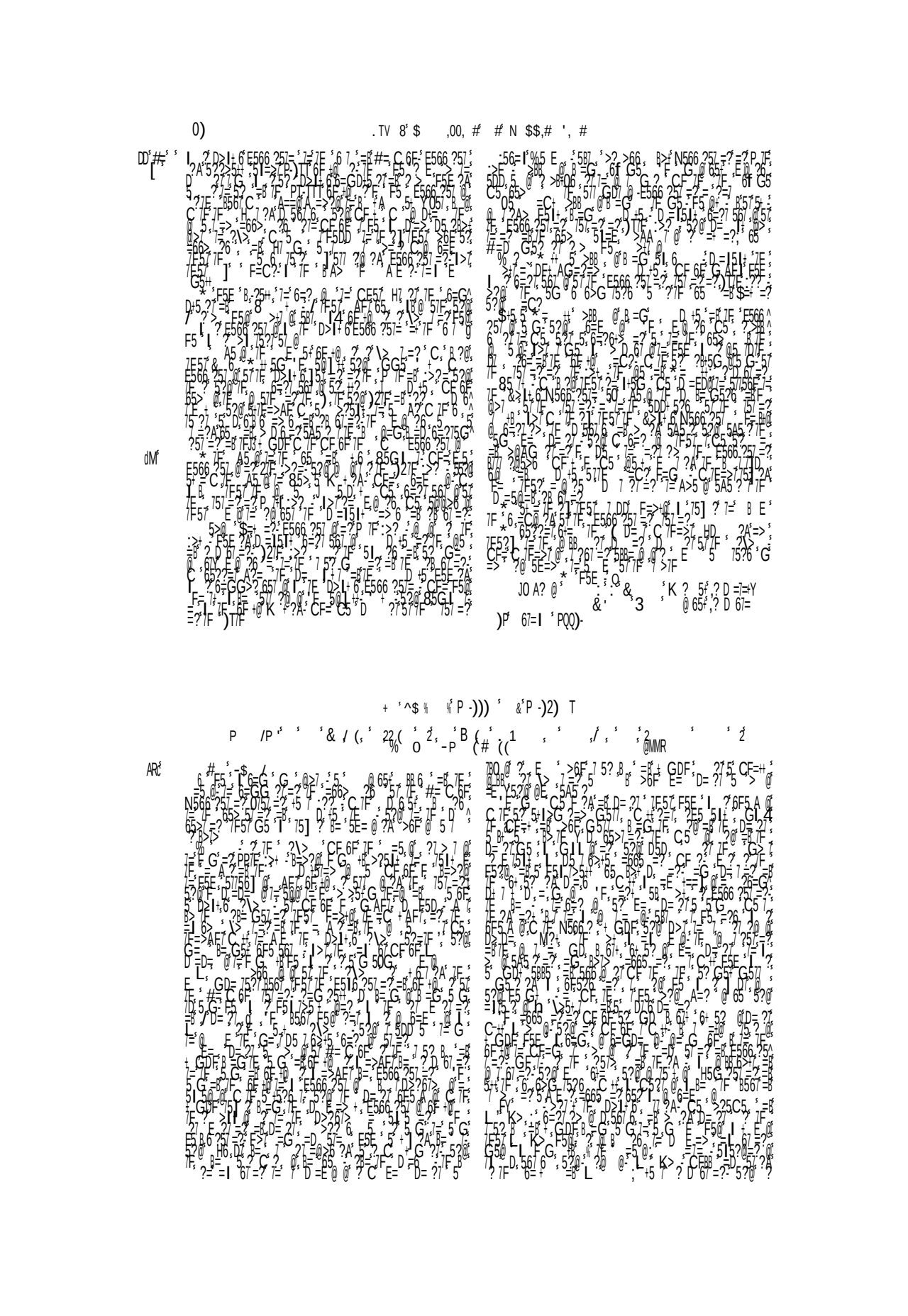

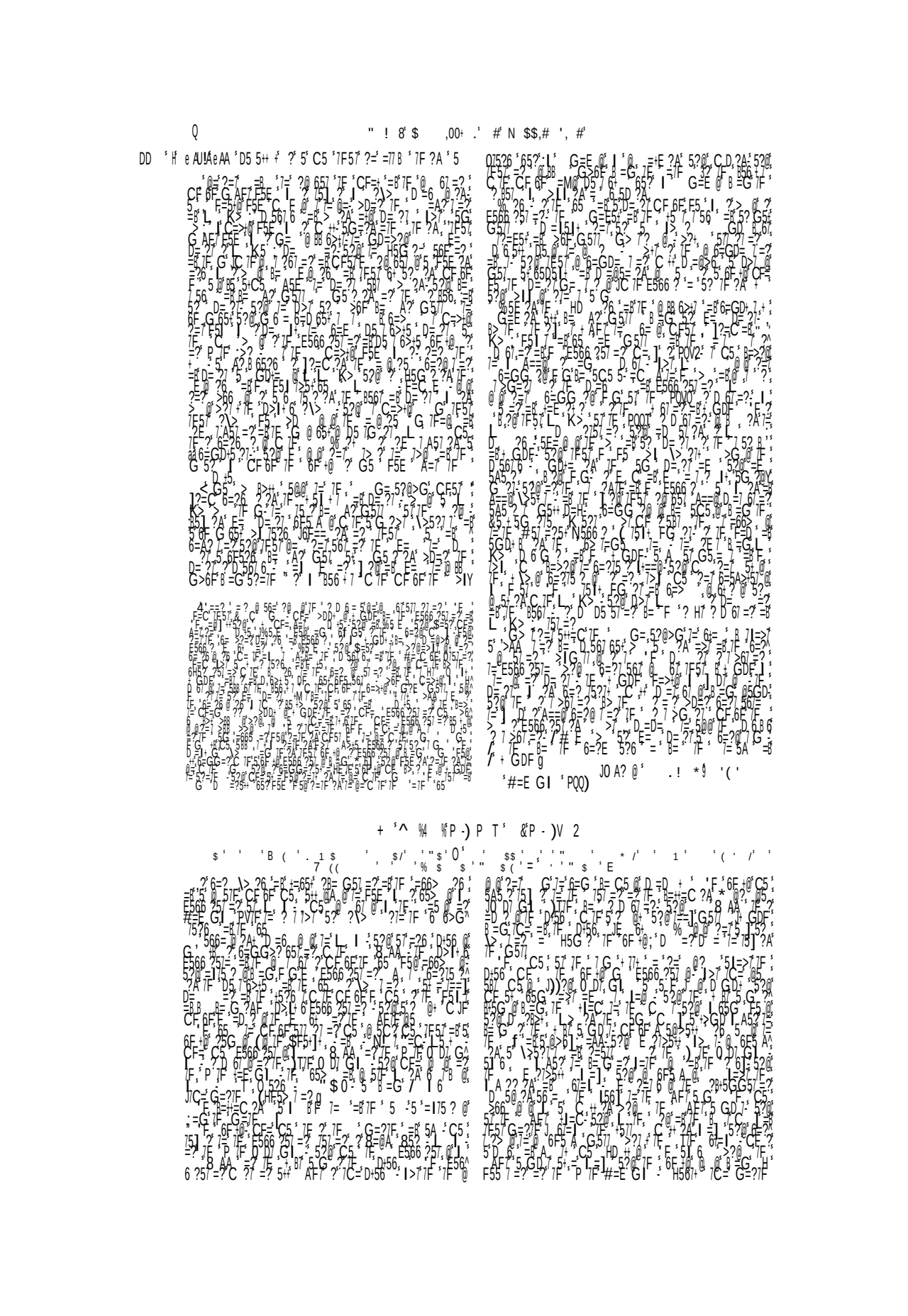

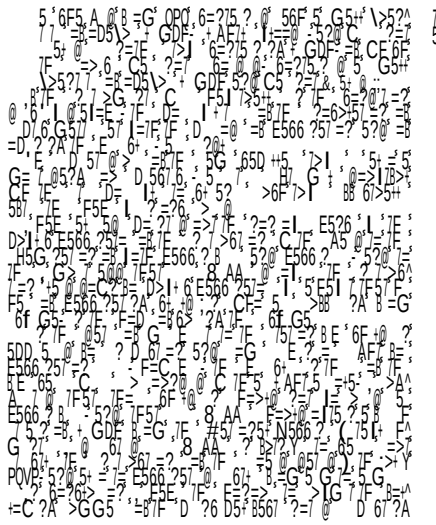

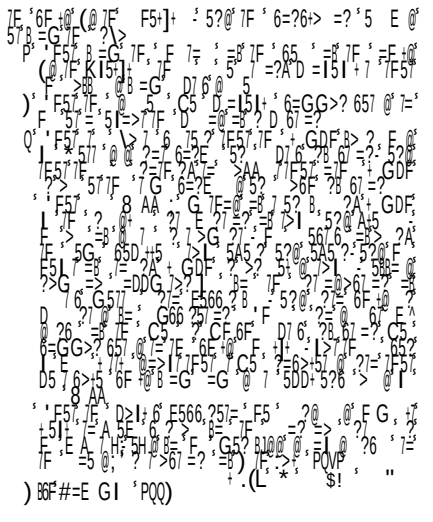

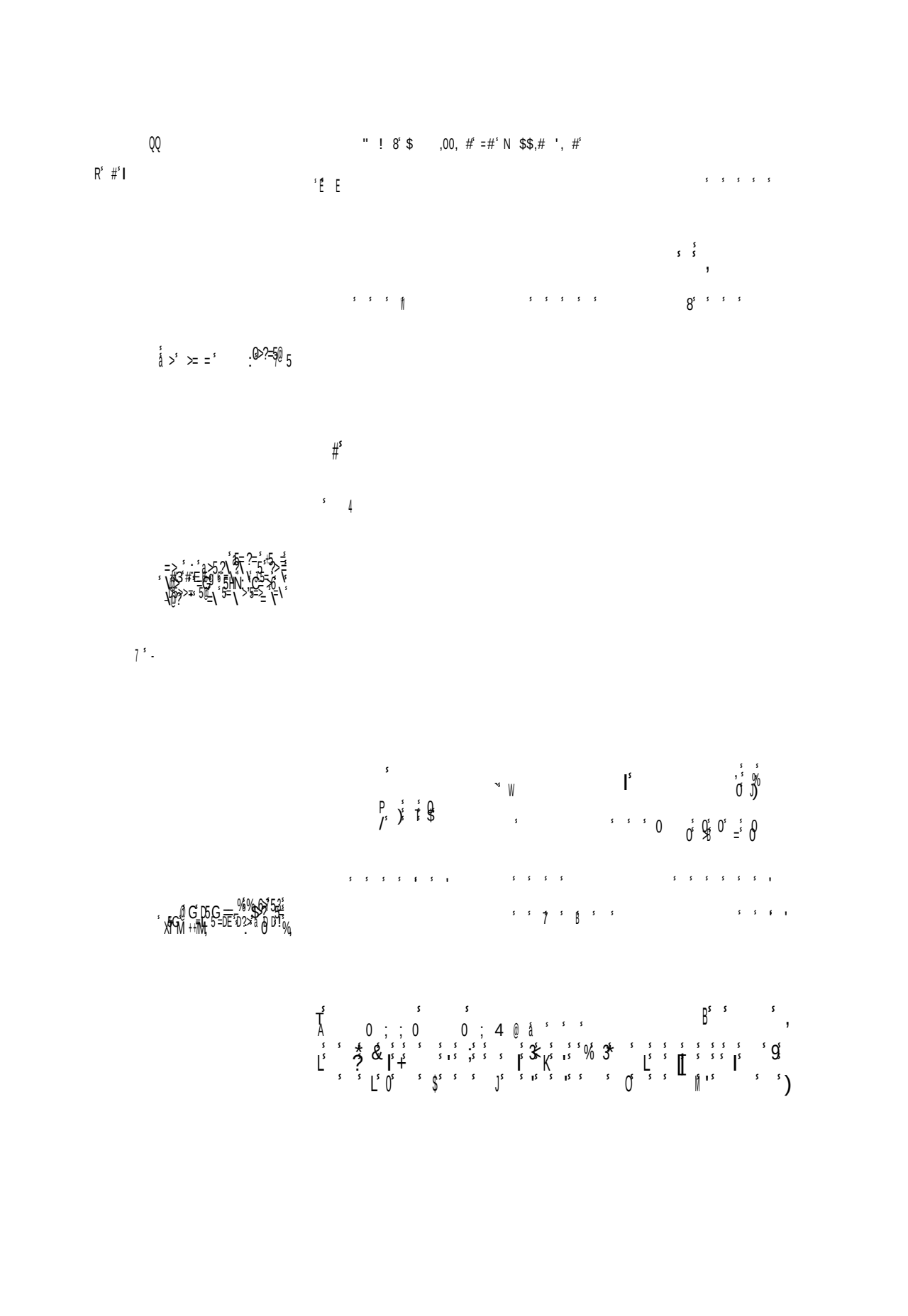

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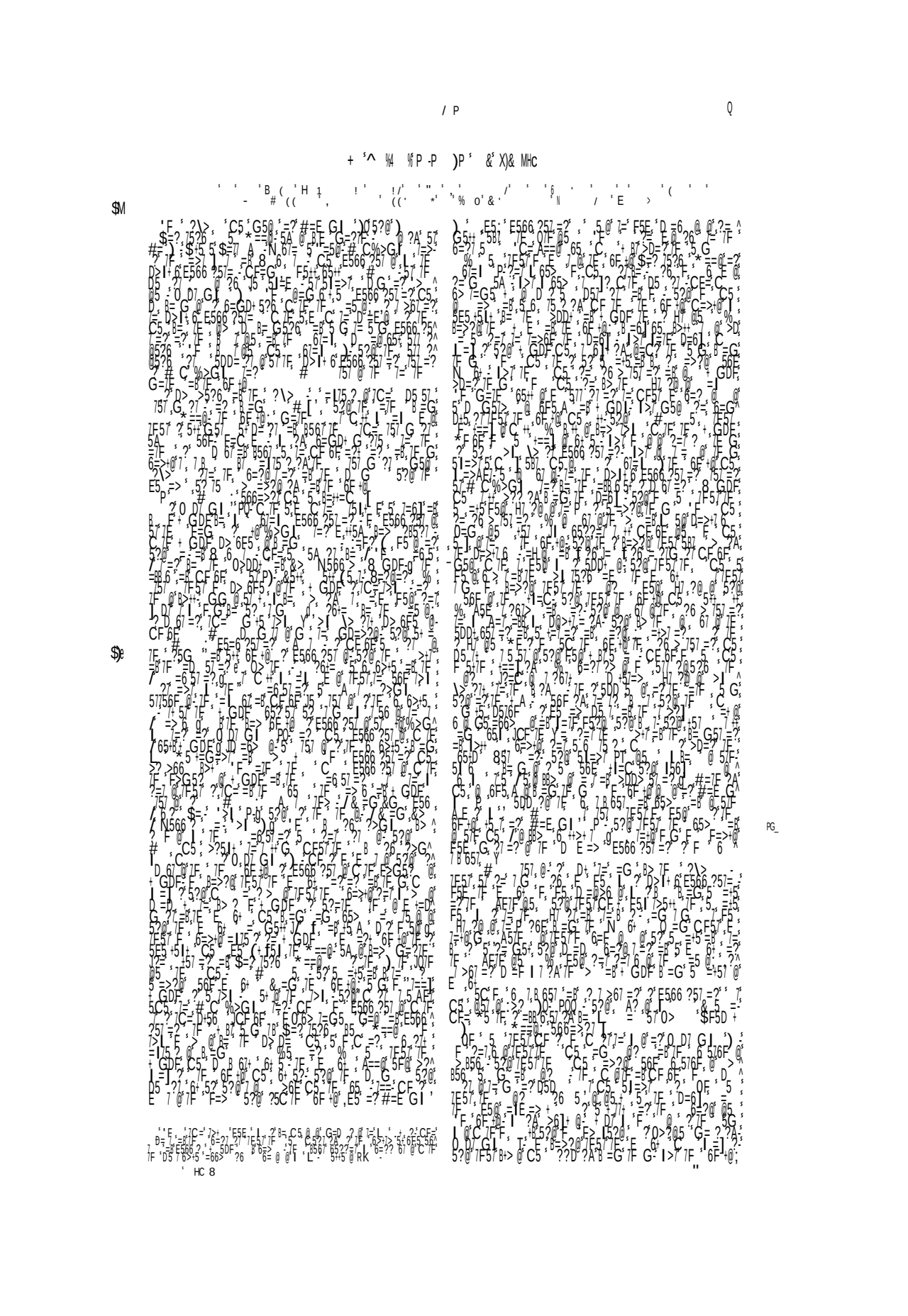

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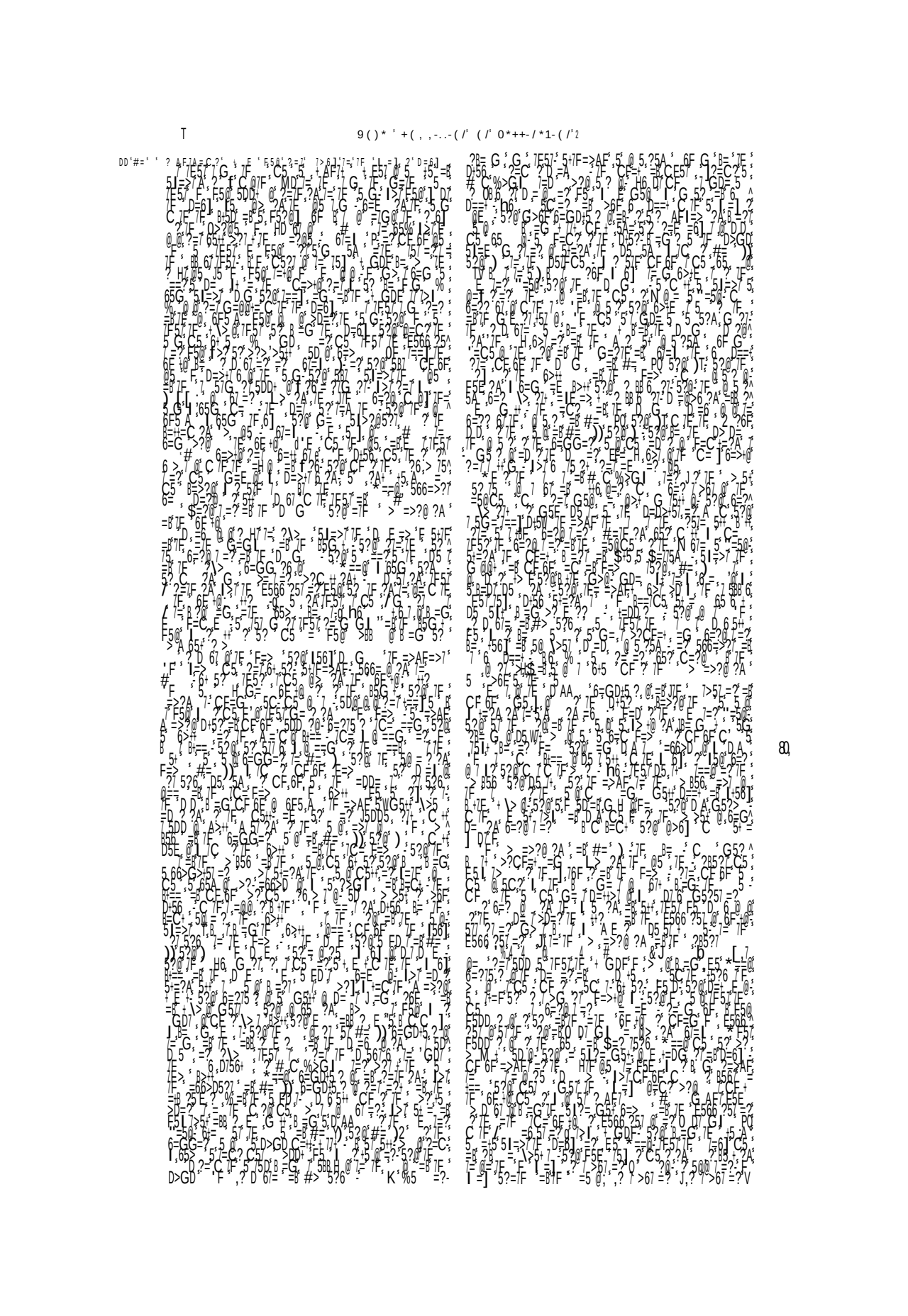
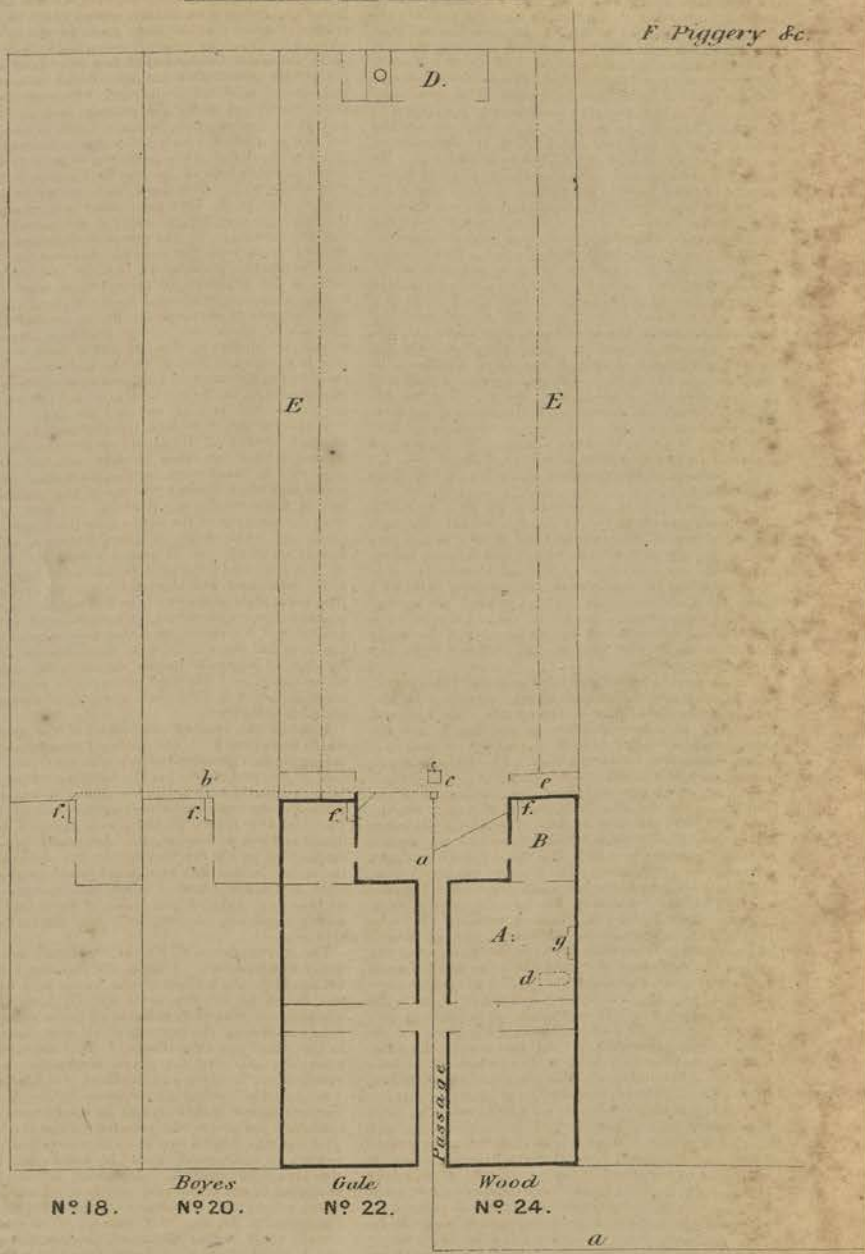


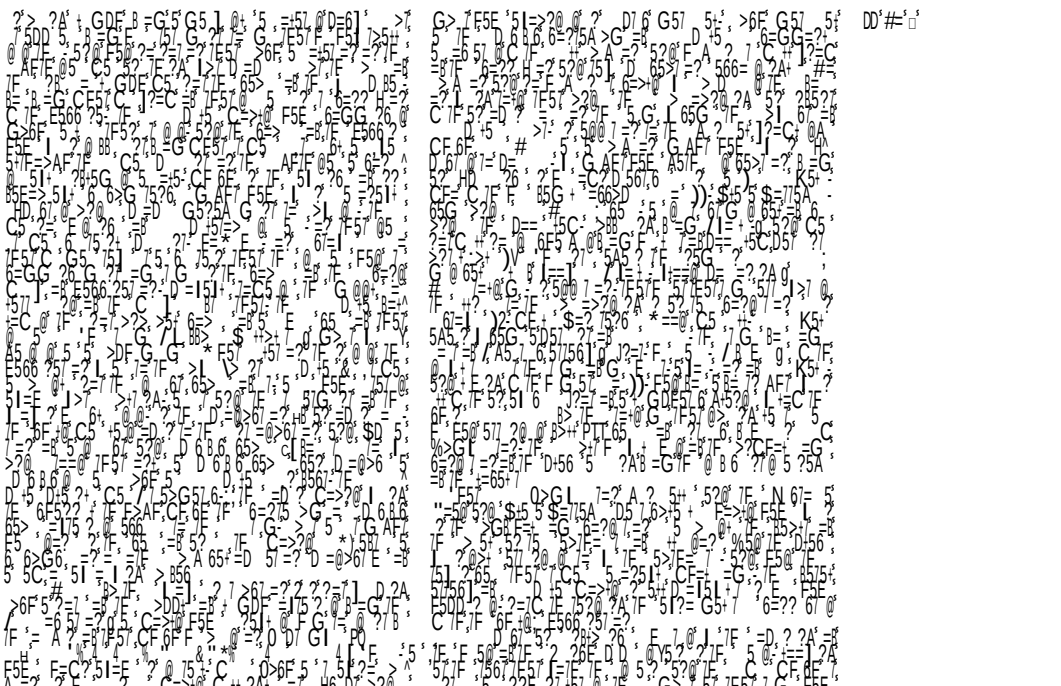
ROUGH GROUND PLAN OF "CLARA COTTAGES" NEW HUMBERSTON.

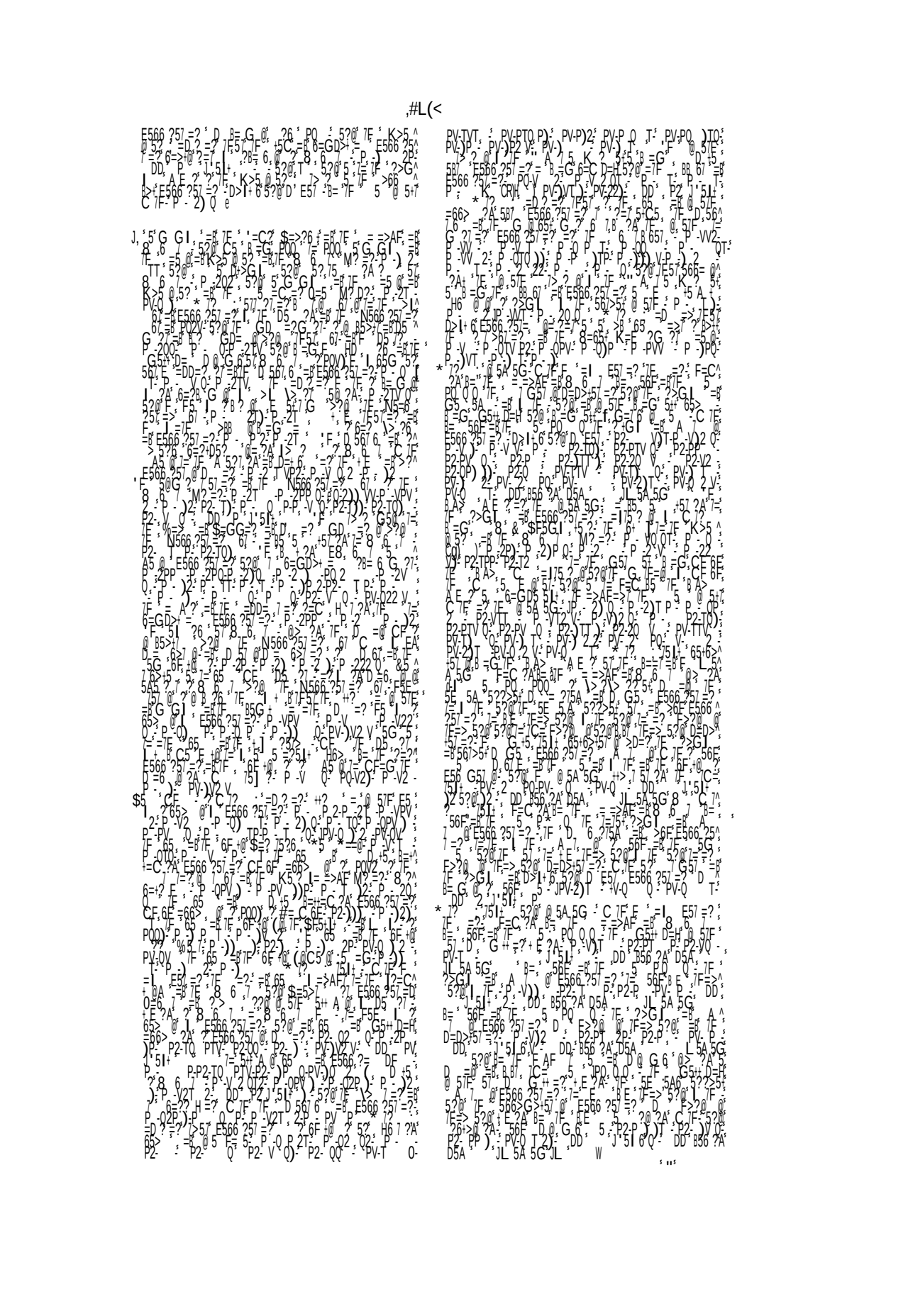


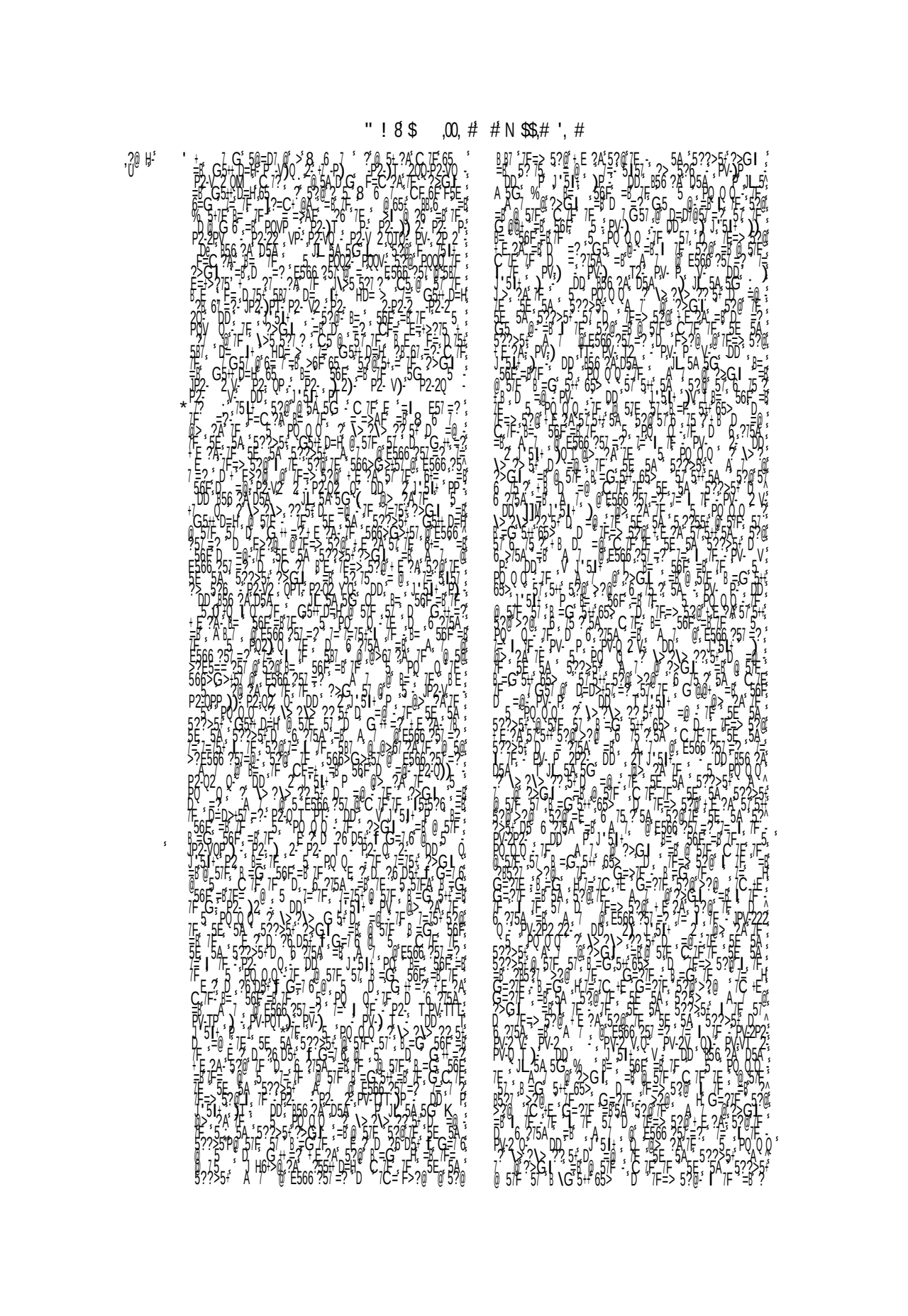
A. Kitchen where Constance habitually lay in day time
B Scullery opening from kitchen and into yard -
D Privy and Ash pit.
E Covered cages for fowls.
F Piggery &c, mentioned in Report (a greengrocer in Overton Road.
a Pipe drain from pump running through passage between houses - unventilated
b Drain that was newly made from adjoining houses in October.
c Pump
d customary position of cradle
f sink.
g fireplace
e Fowls house for Roosting

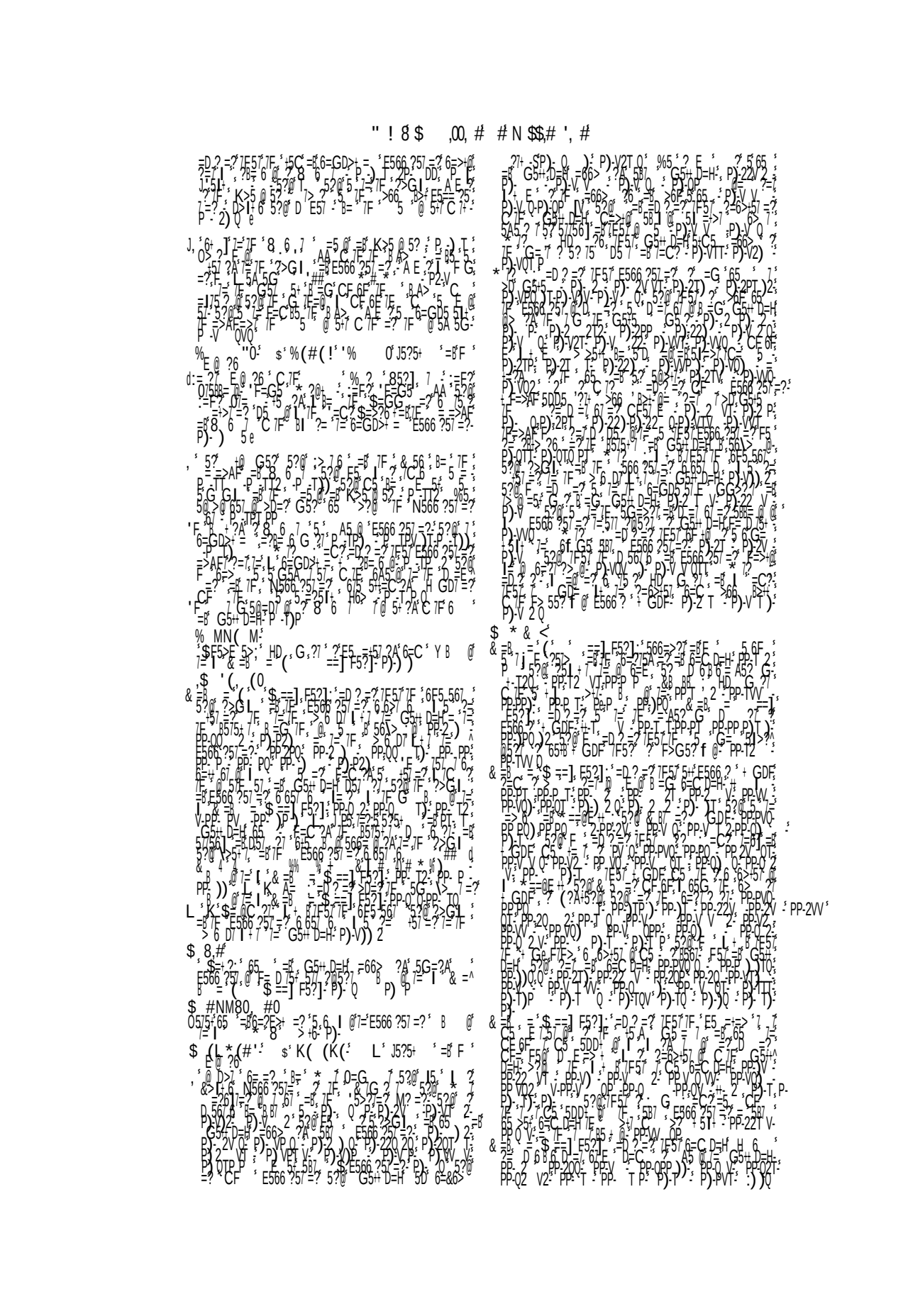
To face page 490.

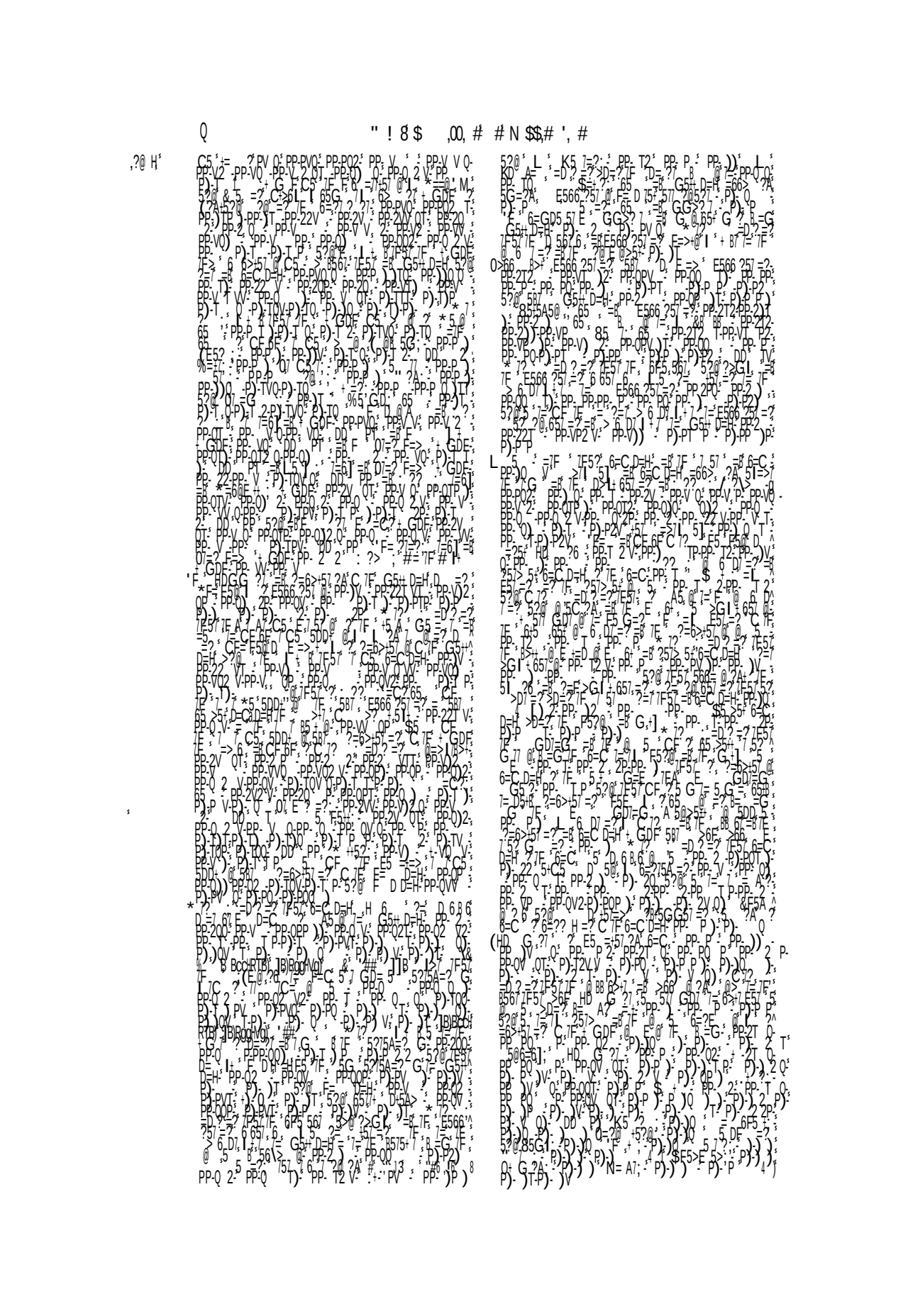
Judd & Co Ltd, Lith. 63 Carter Lane











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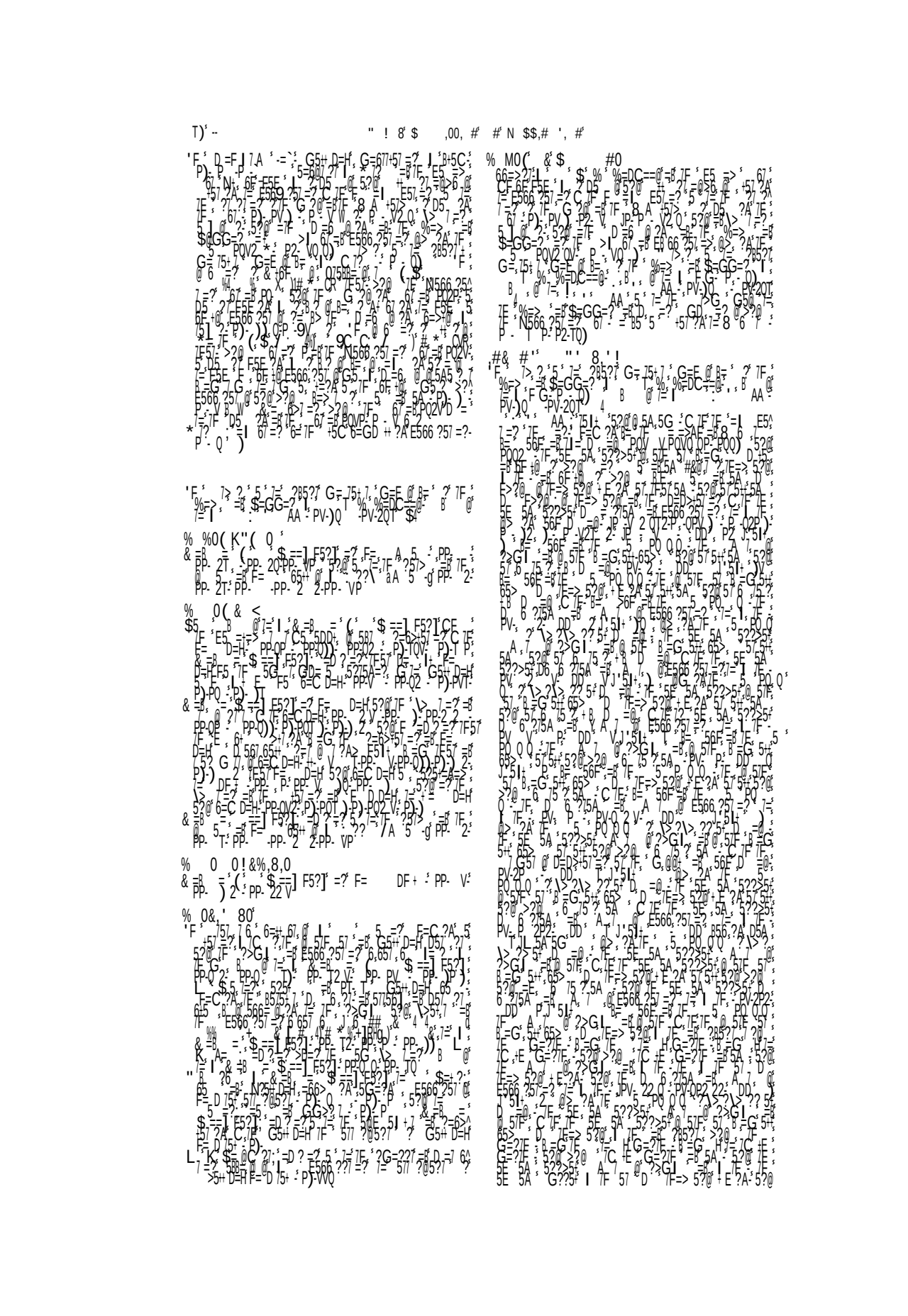

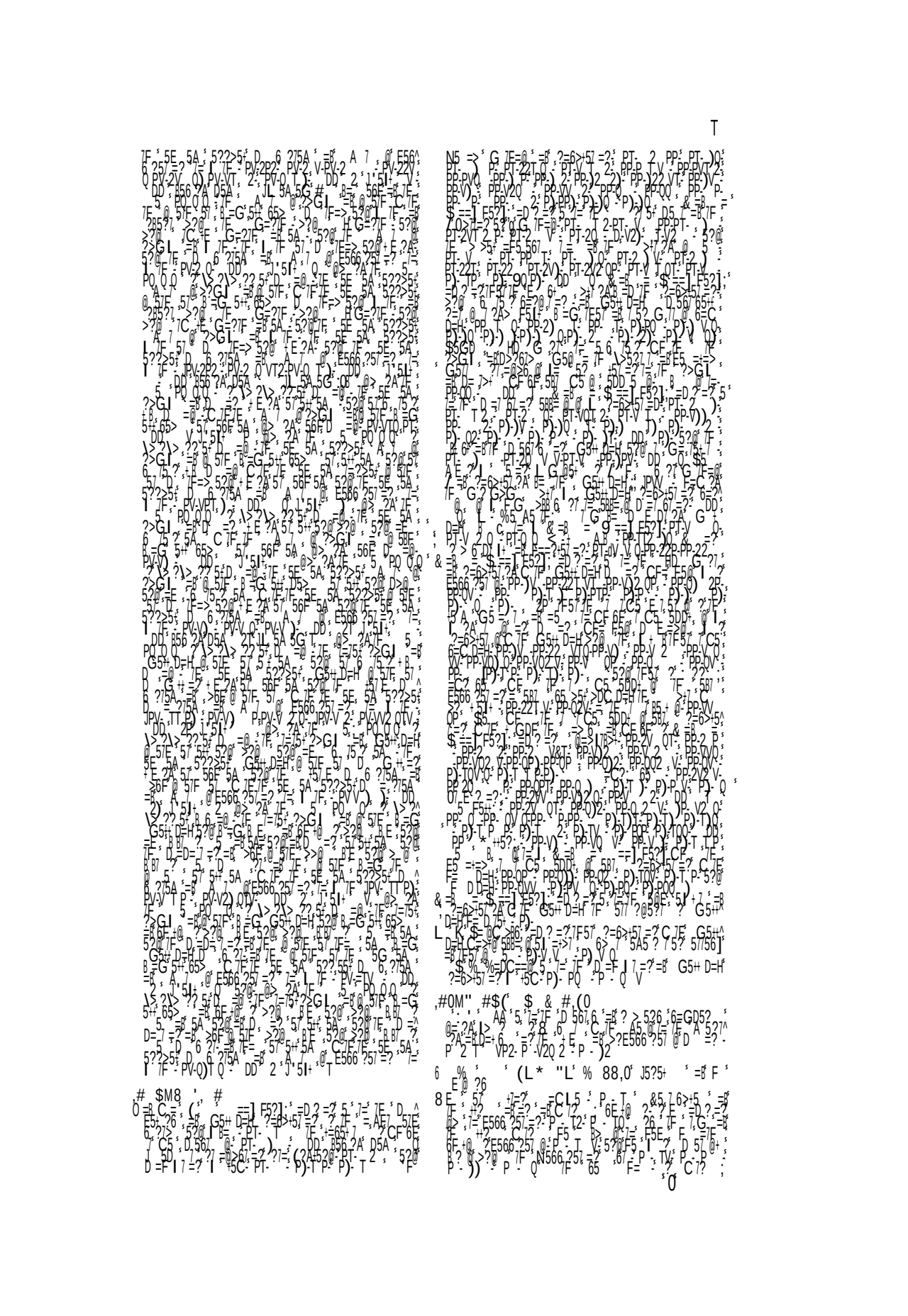

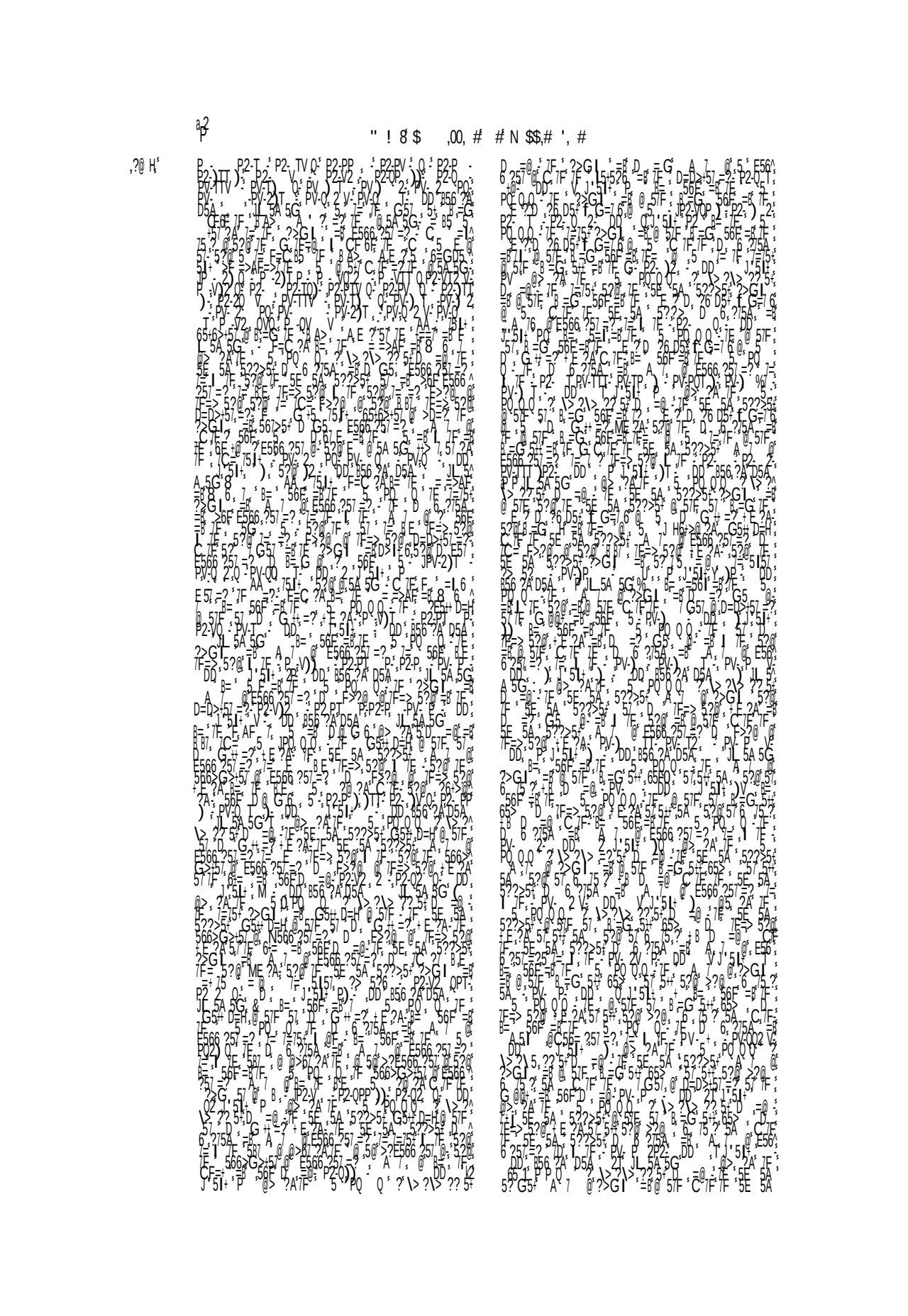

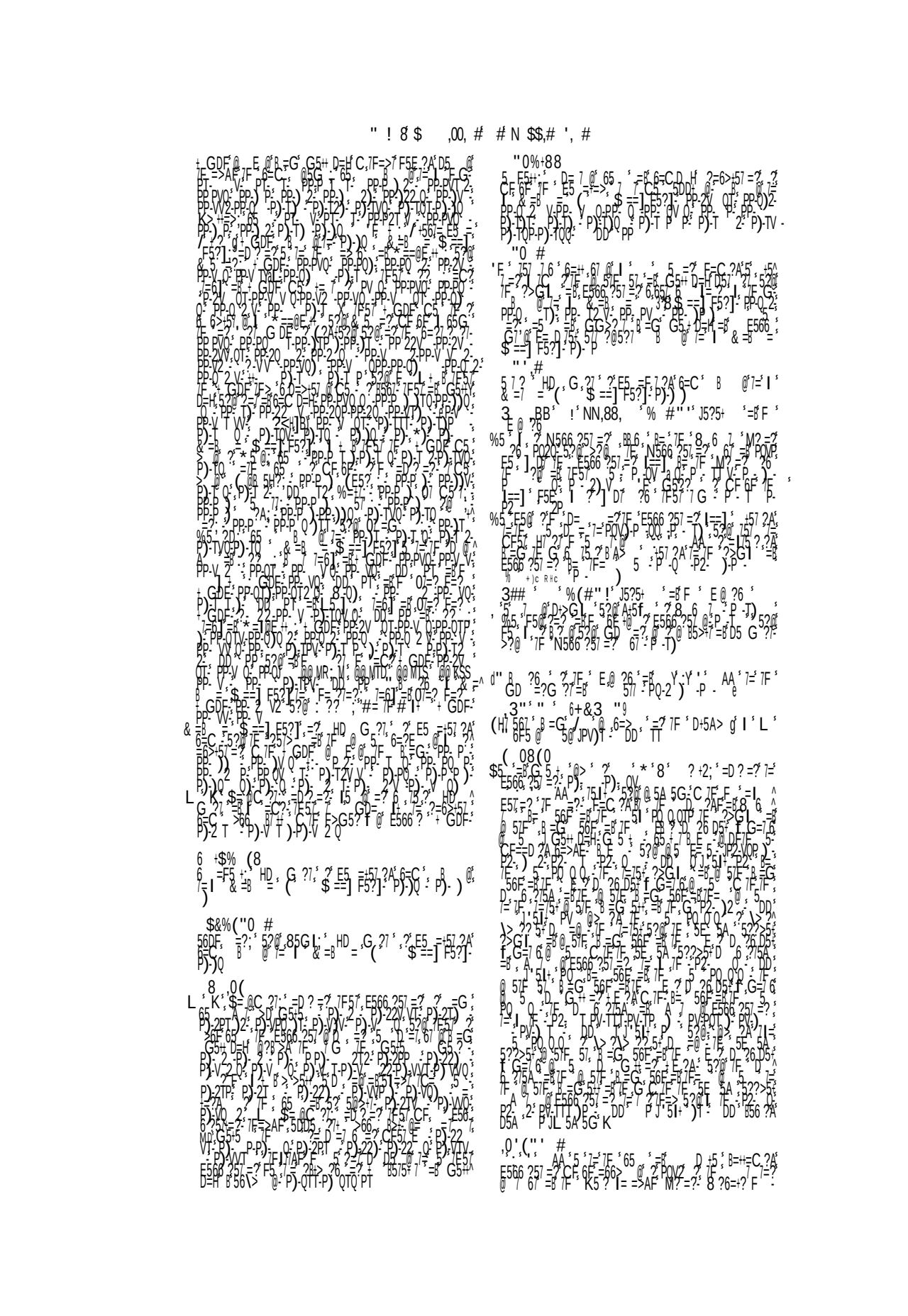

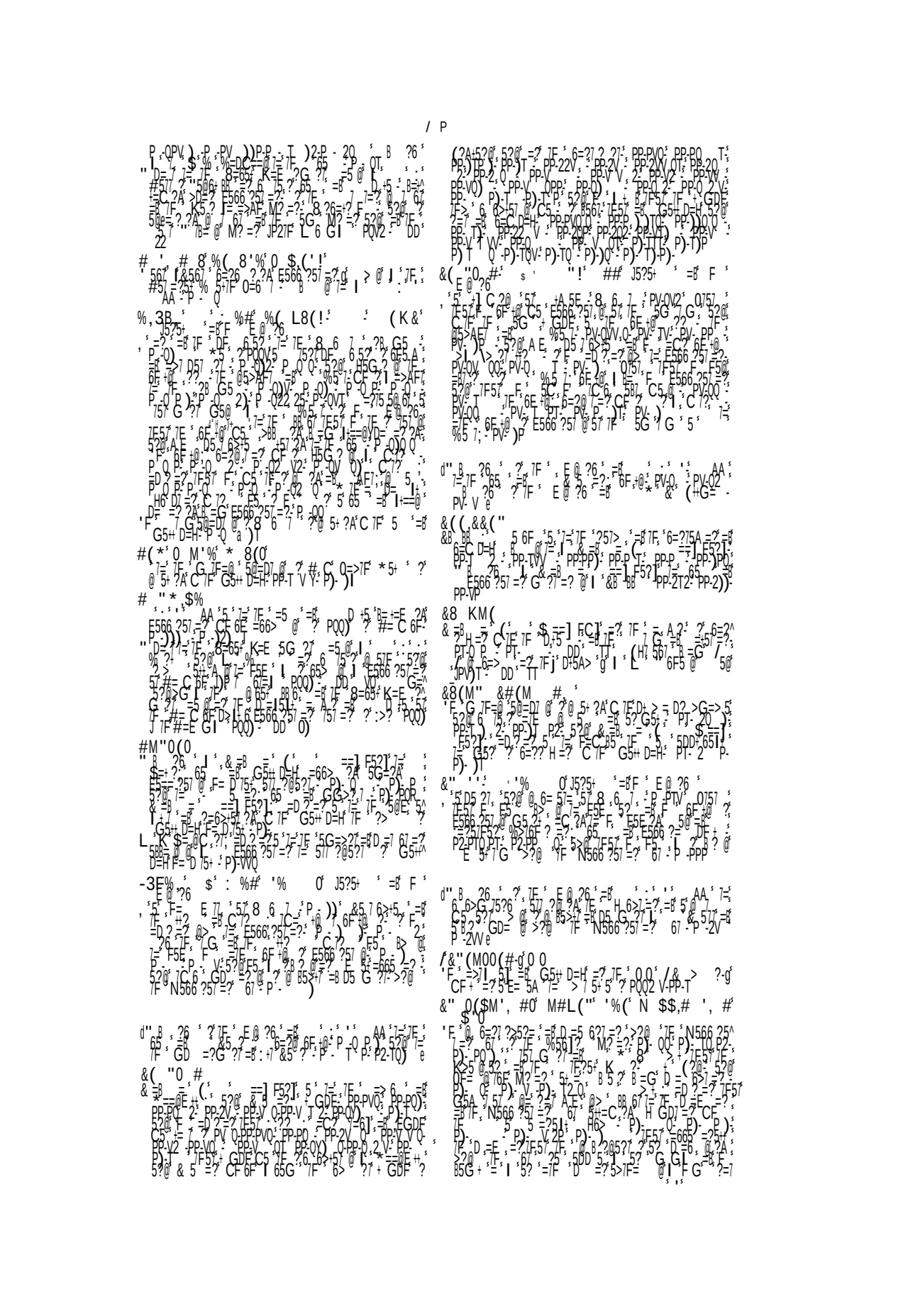

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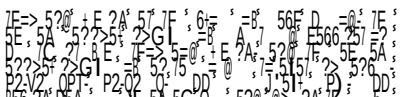

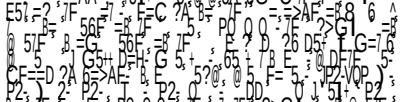

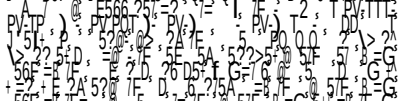

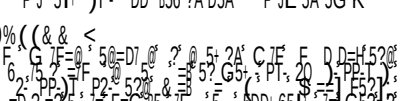

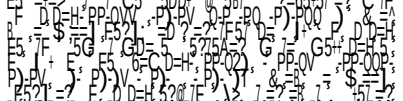

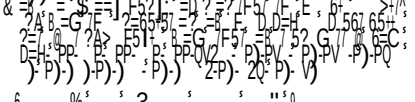

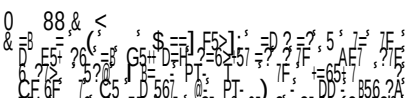

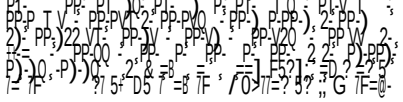

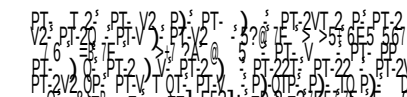

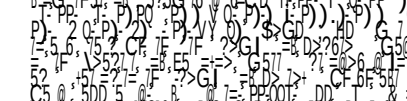

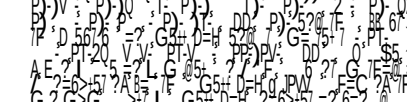

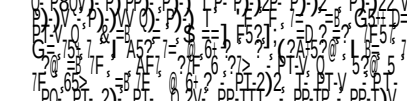

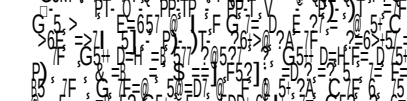

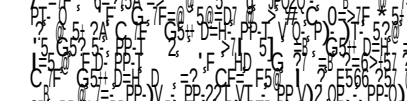

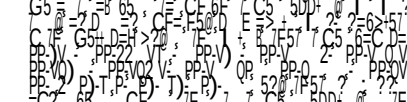

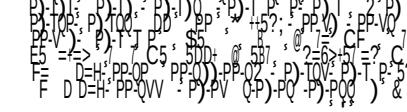

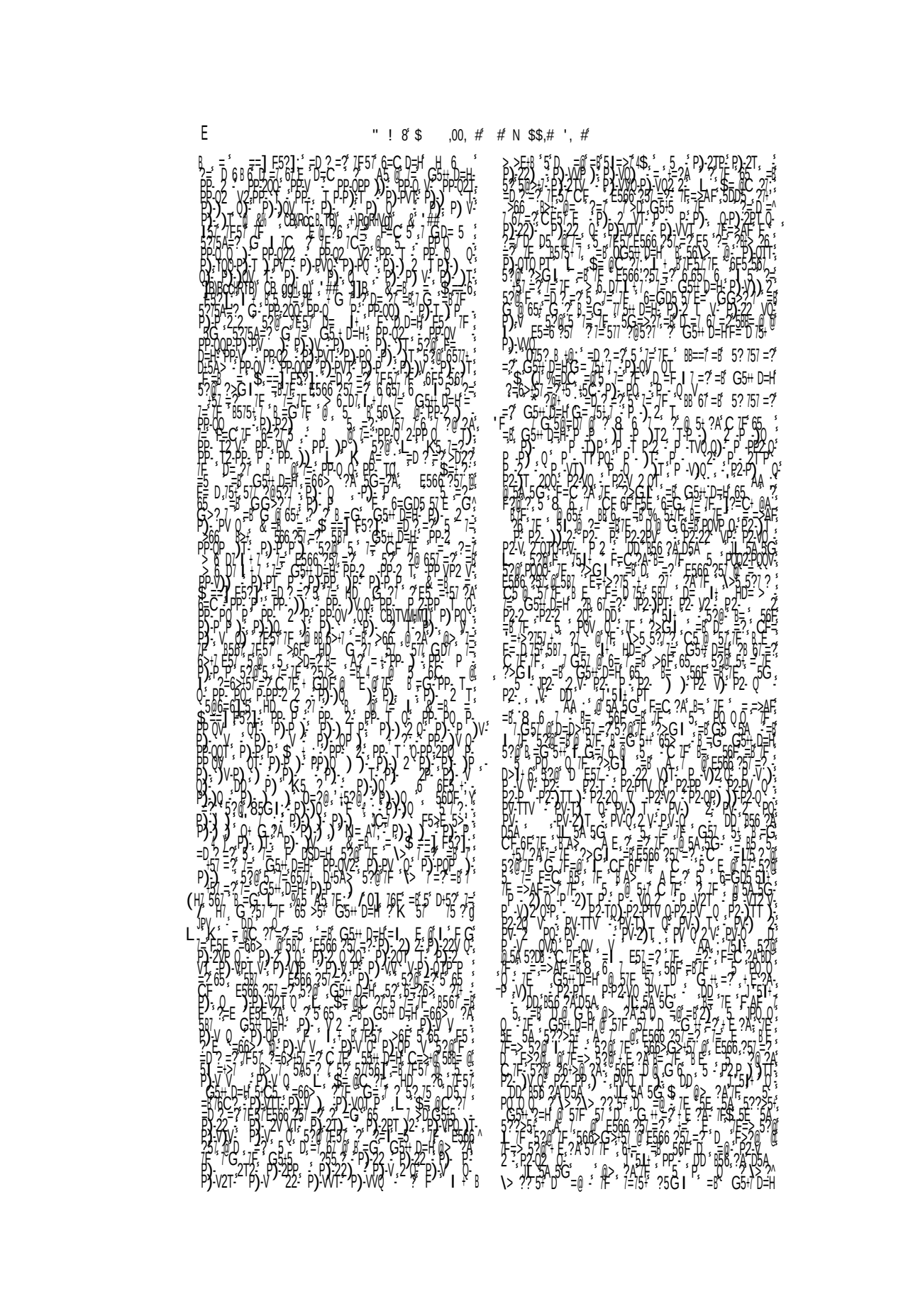

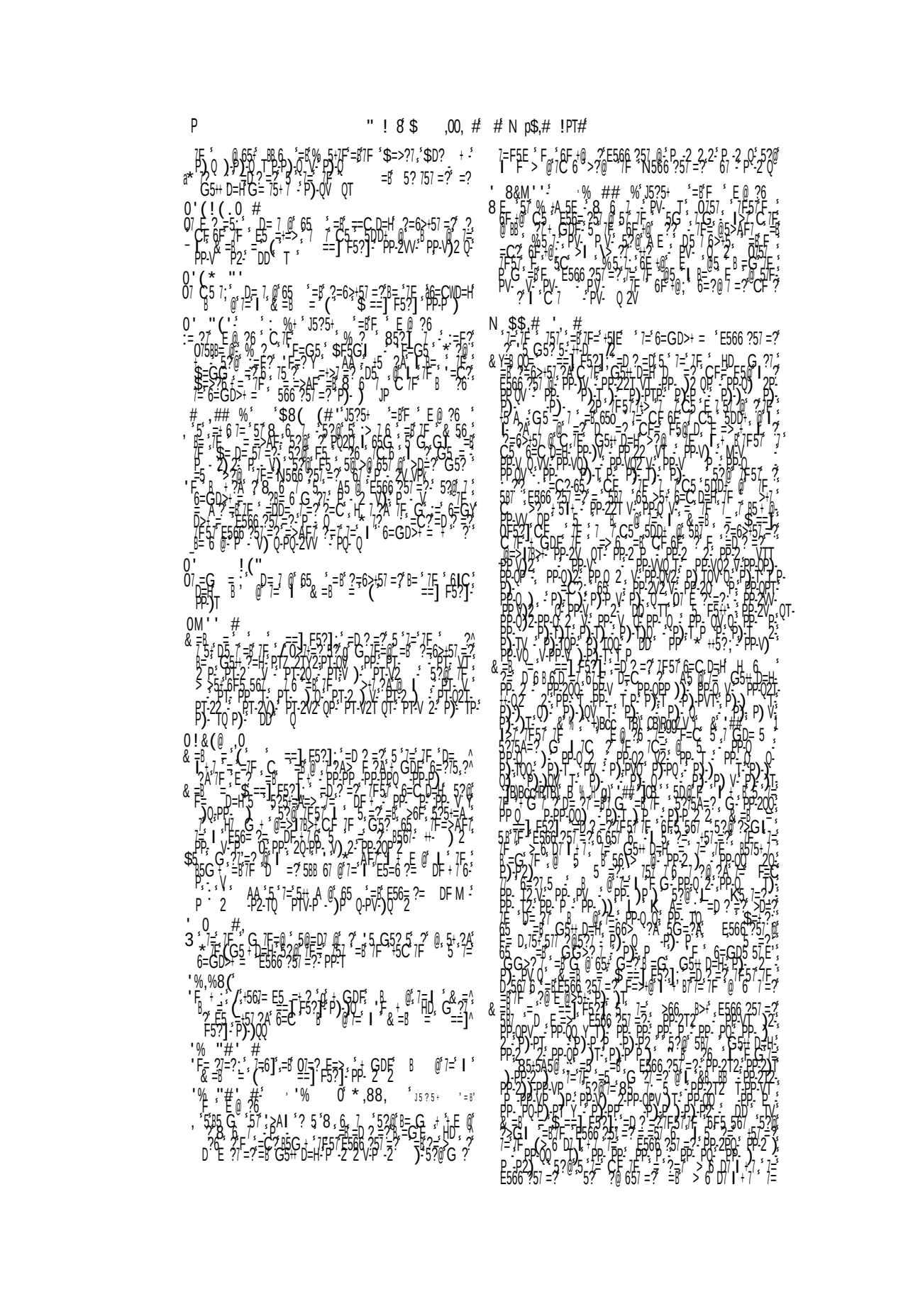

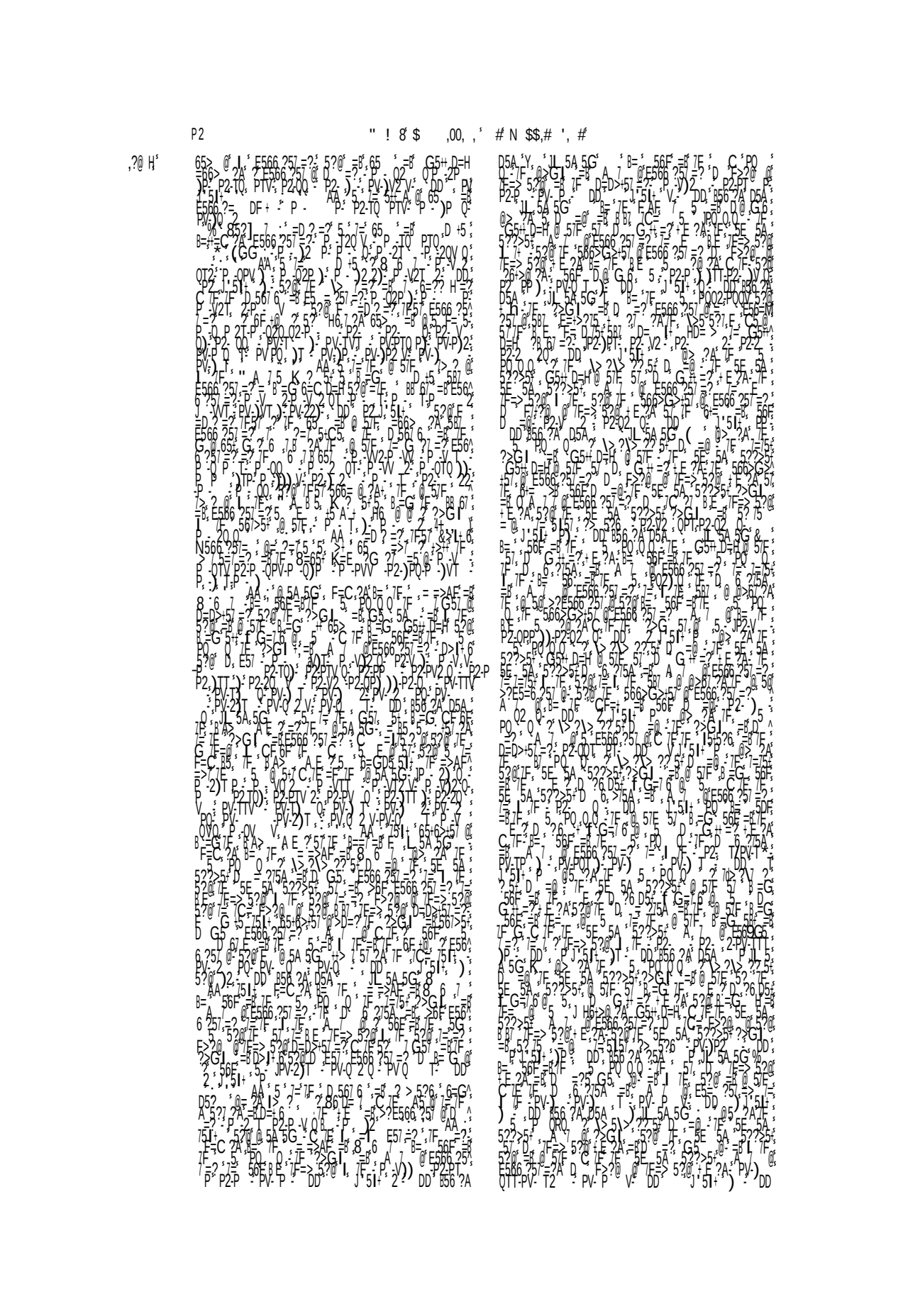

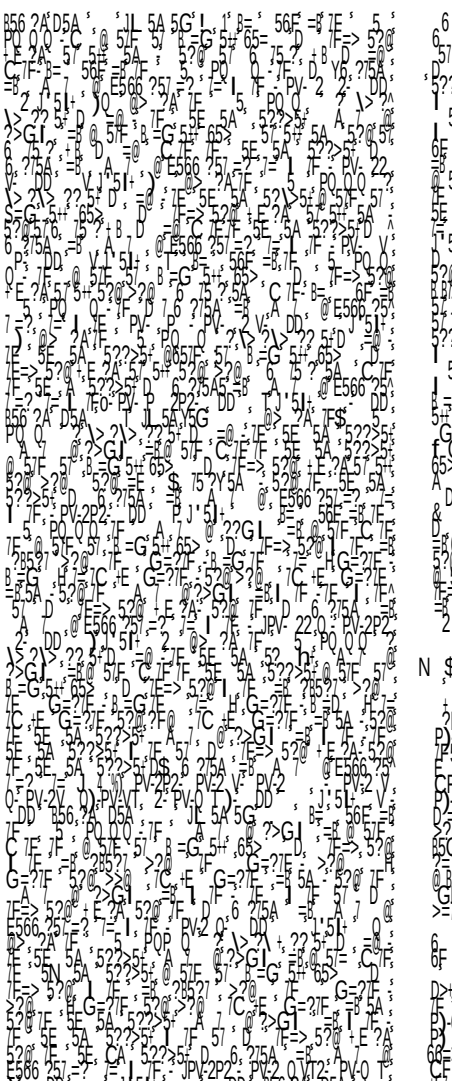

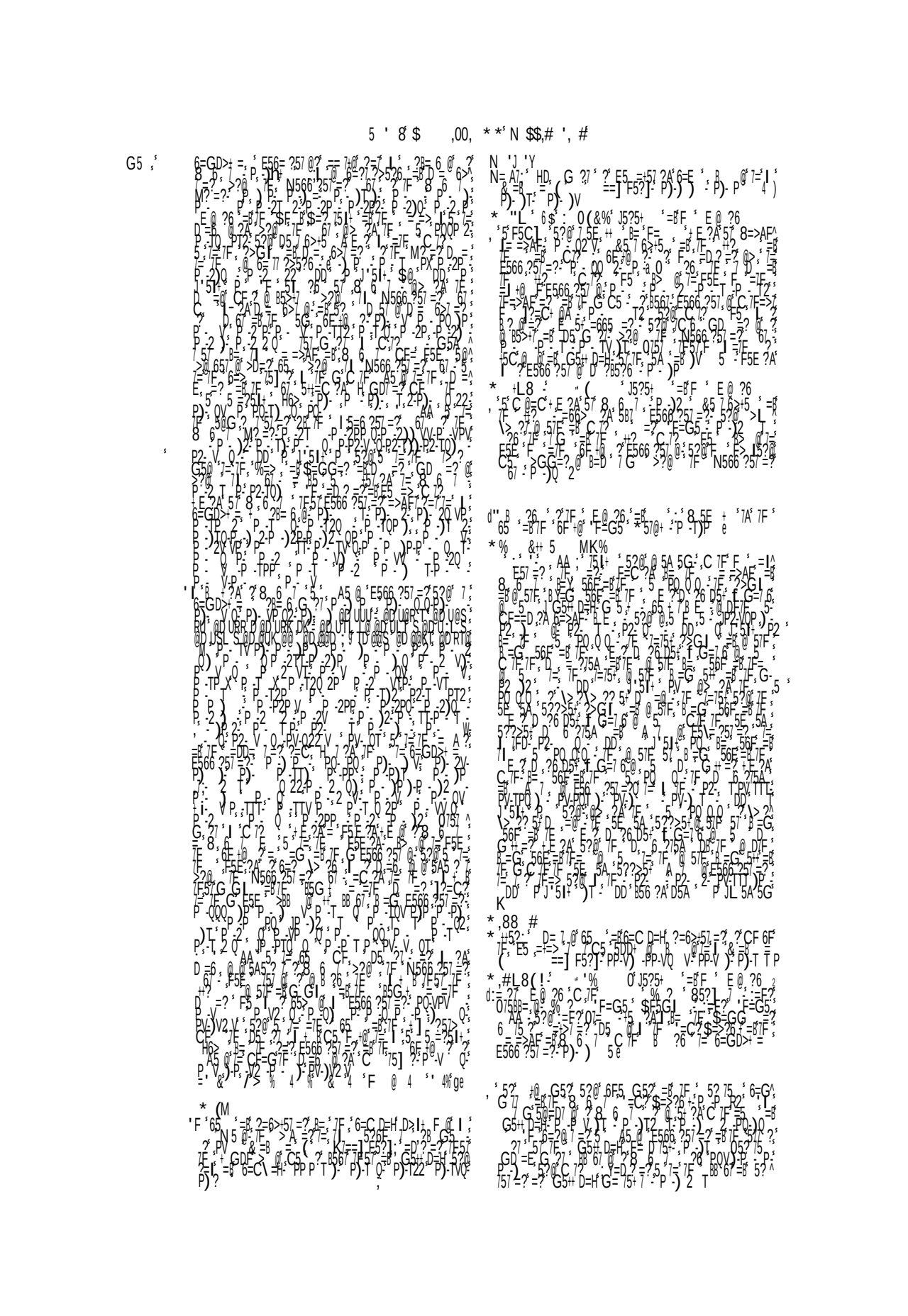

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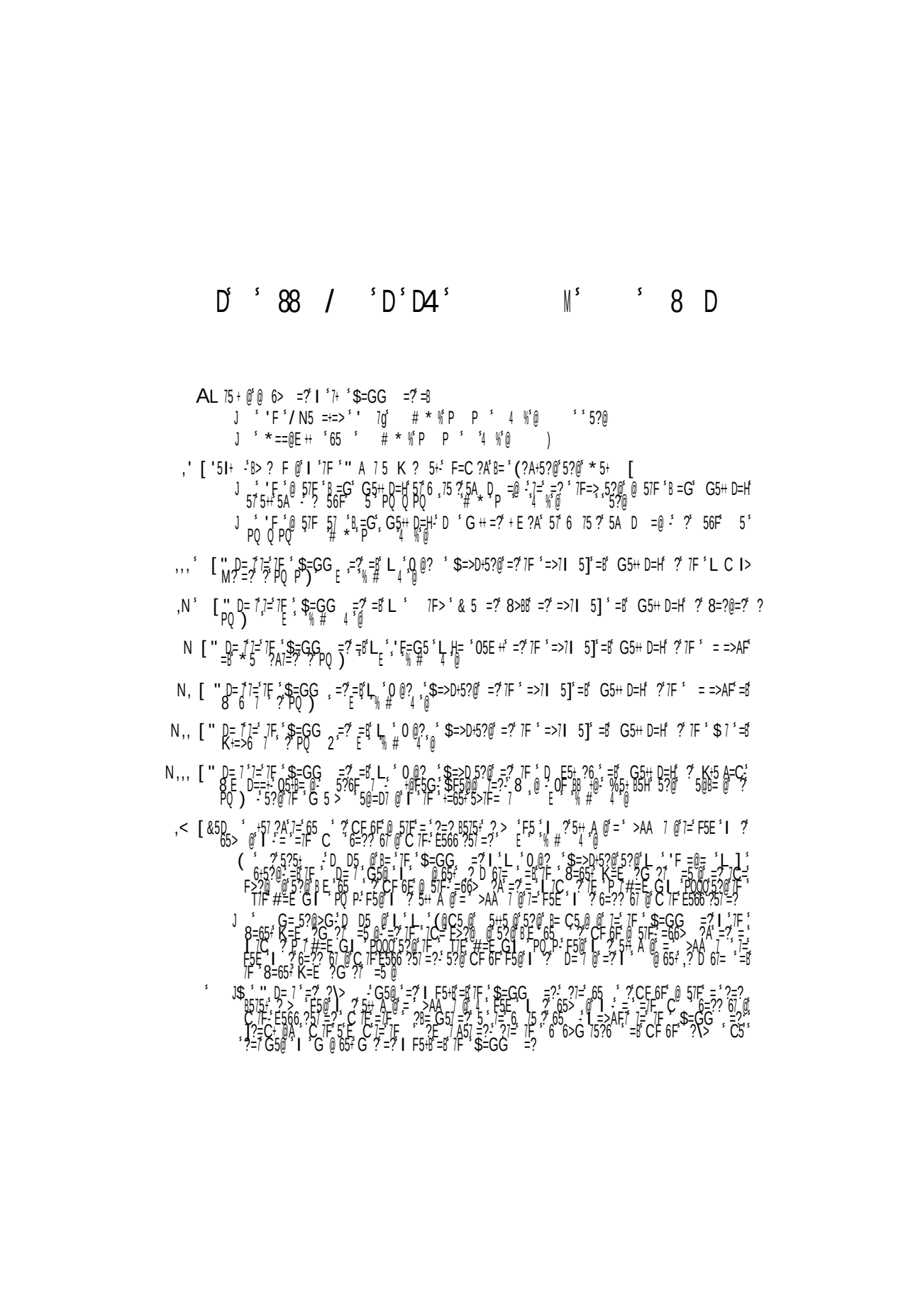

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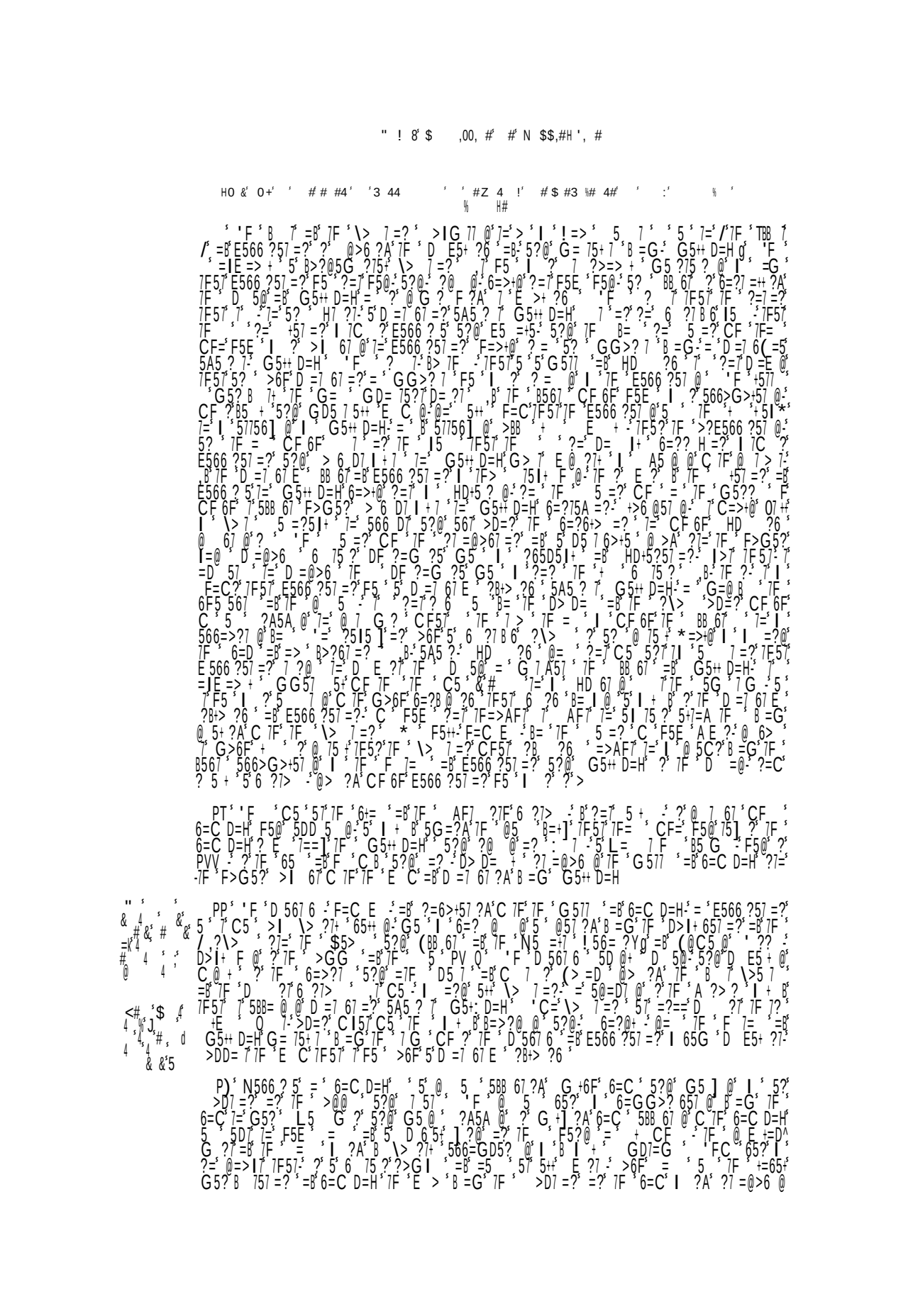

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PV , 7 6 75 ? 7F57 : ?? I + E @ 7F57 7F= CF= F5@ >BB @ B =G 6=C D=H- CF 7F 25?> 5++ = 5 7 B 6 5++ D =@>6 @ HF I 7 @ CF ?7F E5 =+=> 7 7 C 5 5DD+ @ DF ?=G ?5 G +5 7= 7F= C ?? @ ? 7F 65 =B D =? CF= F5@ >BB @ B =G G5++ D=H 5?@ @ BB ?A B =G 7F DF ?=G ?5 =I E @ ?7F= CF= ? = @ ?=] ?@ =B GG>? 7 = D =7 67 =? B E566 ?57 =? I C 7F=>7 D =7 67 E ?B+> ?6 7F =>AF7 ?D7 =F5E I ?7F 65 GD7=G F=>+@ F5E I ?7F= =B D =? CF= F5@ ?D7 >BB @ B =G G5++ D=H 5?@ ? = @ ?= D =7 67 =? 5A5 ? 7 7 B : ?? C5 5? F=? 7 C ?? 65 6 + D= I+ 7= I + E 7F57 7F C5 7F 65 % 7 7 C 5DD+ @ B= 7F E D> D= =B @ 7 G ? ?A CF 7F E566 ?57 =? 5BB= @ @ D =7 67 =? , B 7F >+7 D ?7 @ C 7F 5G 5 C=>+@ F5E I ? HF I 7 @ ? > D =7 67 @ D =? 7 @ BB 6>+7 7= 6=?6 E 7F57 F =>+@ F5E 5 E @ 57 7F 6=?6+> =? 7F57 E566 ?57 =? 6> @ 7F 5G G G>? 7 5 5 D E => 57756] =B G5++ D=H 7 > 7F57 ? H6 D7 =?5# 65 D =? - CF= F5@ ? E >BB @ B =G G5++ D=H- F=C @ CF ?7 7 @ I ?=6>+57 =? 7F 5G 5 5I ?6 =B @ B ?7 E5 =+=> GD7=G 5 7F= CF= F5@ I ? >I 67 7= 7F @ 5 F D =? C D=] ? =B 5 /?57> 5++ ? > = D / 7 F+ @ =B 75] ?A 7F G5++ D=H 7 > 7 D= I+ 7F57 5++ 7F E566 ?57 @ D =? 7= CF=G : ?? 5DD+ @ 7F E5 =+=> 7 7 C 7F> ?57> 5++ ? > 6 D7 I+ >7 7F57 7F F=>+@ F5E 6F5?6 @ 7= I 7F 65 =B 6=> ? 7F F AF 7 @ A GD =I5I+

PO ' F HD ?6 =B : ?? @ @ ?=7 75?@ 5+=? - % >+7 5?@ E C 577 567 @ A 57 577 ?7 =?- 5?@ ? 7F 5 + D5 7 =B 7F 5 PV * ==@E ++ 5?@ & 5 =?- CF= C DF 6 5? 7= 7F OG5+ D=H %= D 75+ ? 8=?@=?- 6=G G ?6 @ G5] ?A HD G ?7 C 7F E566 ? G577 C 7F 5 E C 7= 5 6 75 ? CF 7F 7 5BB= @ @ D =7 67 =? 5A5 ? 7 G5++ D=H ' F 5 E @ +] : ?? 57 7F = ?=+> =? 7F57 7 @ @

P ?:5?>5 PV * ==@E ++ - F5E ?A B=>?@ 6=C D=H 7= I D ?7 ? 5 I @5 g 57 K 5 - ?? 85? - ?=6>+57 @ E ? D =? 57 7F OG5++ D=H %= D 75+ C 7F G577 B =G =? = B 7F 6=C 57 7F / @5 -g 5?@ =7F D =? C 7F G577 B =G =? 5 @5 G5 @ GD+= @ 57 7F 5G D+56 CF= F5@ I 6=G ?8 67 @ B =G 7F 6=C & =G 7F 65 F ?=6>+57 @ ? >66 =? =7F 57 7F %= D 75+ E ?7>5++ 7= 7F ?>G I =B G5? F>?@ @ - 5?@ 7F + 75I+ F @ 7F 7=6] =B CF57 F5 I ? D=] ? =B 5 / * ==@E ++ / + GDF g & 5 =? 5+ = 57 7F 5G 7 G =66>D @ F G +B C 7F 7F \> 7 =? =B ?=6>^ +5 =? C 7F 7F 6=C D=H C 7 ?A 5 D5G DF+ 7 5I =>7 7 * ==@E ++ 5?@ F G 7 I>7 @ 7= G5? D =? ? 7F 6=>?7 5?@ 5I =5@ \>5?7 7 =B 7F + GDF B =G 7F %= ^ D 75+ 5?@ 7F C5 7F I A ?? ?A =B 7F G= A ? 5+ D 567 6 =B E566 ?57 =?- B= : ?? - 7=6] =B + GDF- 7F >+7 =B CF 6F F 5@ @ 6 I @ ? F 7 57 -F5@ 6=G 7= 5? ?@

)T +7F=>AF * ==@E M : / %= D 75+ + GDF g 5DD 5 7= F5E I ? C @ + @ 7 ^ I>7 @ I F G +B 5?@ I & 5 -?- 5?@ 7F> 7= F5E I ? 7F => 6 =B 7F + GDF > @ ? E5 => D+56 ? 7F 5 + @5 =B E566 ?57 =?- 7 C5 ?= 7 7F =?+ => 6 - E ? ? 7F= @5 & 5 =? 5+ = I75 ? @ + GDF B =G 6=C D=H 57 5 @5 ? 7F 5 + I=? =5@ 5?@ > @ 7F / > 6 75 ? 7>57 =? -g CF 6F G5 I D >G @ 7= ?6+>@ + D+56 + CF 7F5? ? 7F % = D 75+ % 5+ = D 5] =B F5E ?A = I75 ? @ + GDF B =G 7F 6=C B =G 5 7F @ => 6 ?? 5A5 ?- CF= 6 E @ 5?@ > @ =G + =B * ==@E ++ %= D 75+ + GDF 5+ = I75 ? @ + GDF B =G =G =7F => 6 B= ? 75?6 - B =G 5 6=C B =G 5 7F @ $+5] B5 G ? . ?7 F '=C ? & > 7F -* ==@E ++ ? POTT D 5] =B F F5E ?A 57 E5 => 7 G ,D =6> @ 7F E566 ? E > 5 D =@>6 @ ? @ BB ?7 6=C -

CF 6F CF ?> @ 57 7F % = D 75 D = @>6 @ 7F 5G BB 67 5 7F K 5 : ' ? 5? + GDF * 5 ?= > 7 B @ ? 5 >G ?A 7F57 5? 566=>?7 =B E ? C => 6 =B + GDF C5 D>I+ F @ 5?@ 7F G5 F5E I ? =7F - GD= I+ 7= 5 F=C G5? 7F5?7F= > 7 G ?7 =? @ ? 65 * ==@E ++ : %= D 75+ + GDF C5 ?=7 7F =?+ + GDF > @ ?7F= 5 + @5 ?=7 =?+ F=C E C5 7 +5 A + > @ J ?@ @ C F5E ?= E @ ?6 =B = C @ D 5@5> =B + GDF @ E @B =G 5? =7F => 6 I> 7F > =B 7 G5] 7F @ B ? 7 I A ?? ?A =B 7F D 567 6 =B E566 ?57 =? 5?@ 7F F 7= =B 7 @ G5?@ D 6 5+ ?=7 6

)P B 7F 65 6= @ @ I * ==@E ++ ?F " D= 7 7F +5 A ?>GI 5I=>7 7F B B7F D ?7 @ 5? GD= 75?7 5?@ 5 6=GD5 @ C 7F : ?? 65 5 ? C B 57> ?7F57 ?5@@ 7 =?7 7= 7F 6F5?A 75] ?A D+56 57 7F 57 =B ?=6>+57 =?5?@ 6=? 7 7>7 ?A CF57 * ==@E ++ 65++ @ 7F / 6=C D=H 7>G=> G CF 6F G5 F I D=] ?7 =B 5 7F / E566 ? E 6+ G 5? >D7 =?7 =E 7F I=@ =B 5 A 57 = + ?>GI =B D> 7>+ C5 =I E @ 'F >D7 E D> 7>+ =66> @ ?7 7F E B 7 65 =B 7F E ?7 =5 ?=6>+57 @ B =G 7F 6=C B=> 5?@ =B 7F B E ?=6>+57 @ B =G 7F @5 G5 @ B=> F5@ >6F D> 7>+ 5?@ 7F 5DD 5 52 6 6= @ @ 5A5 ?7 5?@ 5A5 ?7 7F =@=C?7= 7F 65 CF 6F 5DD 5 +5 7 I>7 =? ?7 7F 75I>+5 757 G ?7 B= G ?A D5 7 =B 7F '' D= 7 = E 5? >D7 =?7 =B D> 7>+ @ 6 I @ ?7 6 75 ?7 =B 7F =5 =B CF 6F 566=>?7 C D>I+ F @ 57 5I=>7 7F 5G 7 G I & 5 =?7 5?@ G5? =7F ?7 =G =B 7F 65 7F + GDF > @ C5 >DD+ @ B =G 7F OG5++ D=H %= D 75+ I * ==@E ++ = & 5 =?

)) 7 G> 7 I 5@G 77 @- 5 C ++ I ?7 B =G 7F @ 75 + @ @ 6> =?7 CF 6F C A E ?7 5?7 5DD ?@ H 7 D5A P P 7F57 7F ?7 D> 7>+ C D> 7>+ =B G5++ D=H 5?@ 7F57 7F B= * ==@E ++ ; 65 CF 6F @ @ =7 G>6F 7= 75I+ F 7F 7 D 567 6 =B E566 ?57 =?7 C ?=7 65 GD+ =B 6=C D=H I>7 =B 6=C D=H G H @ 7= D 5] C 7F G5++ D=H 7 F5 ?@ @ I ?7 G5 ?75 ? @ 7F57 * ==@E ++ 65 C =B 6=C D=H 7 F5 7 ?7 =@>6 @ ?7= 7F E B 7 65 7F57 7F F 7= =B 7F CF=+ 7F F 7= =B 5 =B G5++ D=H =5 D>7 ?A =?7 D 6 5+ 6F5 567 5?@ 7F57 7F B= 7F + GDF > @ 5?@ @ 7 I>7 @ I * ==@E ++ 5?@ & 5 =?7 C5 ?7 5+ 7 ?=7 6=C D=H + GDF I> G5 + D=H + GDF >7 5 @ 75 + @ @ 6> =?7 =B 5++ 7F B567 >6F 5 C ++ I B=>?@ 57 D5A P P F=C 7F E C 7= I >?7 ?5I+ E C =B 5++ 7F E @ ?6 5E5 +5I+ + 5@ 7= ?= =7F 6=?6+> =?7 7F5?7F57 F=C E G>6F ?7 * ==@E ++ & 5 =?7 5?@ =7F 65 6=C D=H C5 G H @ >D7 C 7F G5++ D=H 7F + GDF ?7 @ 5F@ @ 7 I>7 @ I * ==@E ++ 5?@ & 5 =?7 5?@ 65++ @ I 7F G 6=C D=H + GDF J H6+>@ ?A =B 6=> 5++ 7F 65 =B CF 6F 7F C ?=7 5 B C ?7 CF 6F G577 C5 75] ?7 B =G 7F + =65+ / 6=C D=H 7>G => G 57 7F 57 =B ?=6>+57 =? I>7 B =G =? =B 7F >D7 E D> 7>+ C5 E 75I+ 6=C D=H + GDF F5E ?A 7F 7 > 6F5 567 =B 6=C D=H + GDF =?+

) 7 =B 6=> B=++=C 7F57 7F 5 =5 I=7F ?7 * ==@E ++ D 567 6 5?@ ?7F57 =B =7F ?7 CF 6F 7F ?=6>+57 =?7 =B 6=C D=H G577 C5 566=GD5? @ I 5?7 >D7 =?7 =B D> 7>+ @> 7= G5++ D=H I ?A D ?7 5 C ++ 5 6=C D=H CF ?7 5DD 5+ @ 7= 5 F=C ?A GG>? 7 5A5 ? 7 G5M D=H JI 7F 7 7 7F =B HD= > 7= 6=?75A =?7 = =B ?=6>+57 =? B> ? F @ B5+ E @ ?6 5 7= 7F57 GG>? 7 I ?A @> 7= 6=C D=H G AF7 F5E I ?7 @> 7= 7F 566=GD5? ?A G5++ D=H O= B5 7F ?7 5 7F 5@=D7 =?7 =B E566 ?57 =?7 C5 5 7 @ I 65 =B 7F @ 6 D7 =?7 G5 I F +@ 7= F5E 7 @ =?7 =? => @575

>7 7F 7 =B GG>? 7 CF 7F 7F57 =B HD= > 7= ?57> 5+ 6=?75A =?7 = 7F57 =B ?=6>+57 =?7 C5 5DD+ @ ?=7 =?+ 7= 7F 65 C 7F >D7 =?7 I>7 7= 7F 65 C 7F=>7 7 ?=7 =?+ 7= =5 CF + GDF =B =7F A ?7 C5 > @ * F5E ?=7 566> 57 6= @ ?5I+ ?A> 7= @ 7 ?A> F=C @ GG>? 7 C D= 5 5 >+ ?=B 75 + ?5I+ ?A> 7= @ 7 ?A> F 7F =5 ?7 CF 6F + GDF =I75 ? @ B =G 7F F= D 75+ C5 > @ B =G 7F= ?7 CF 6F 7F + GDF C5 =I75 ? @ B =G =7F => 6 = ? @ I 7C ?7 7F 65 ?=6>+57 @ C 7F + GDF 7 56 5I+ 7= * ==@E ++ 5 + 65 =B K 5 ;?? 85? = A ?7 5?@ 7F= ?=6>+57 @ C 7F 7F E5 => + GDF =B =7F = A ?7 GD+= @ I * ==@E ++ ! 7 7 6+ 5 7F57 ?= 6=?7 5 7 5 A5 @ 7F GG>? 7

PT ! 8' $,00, # # N TQ,# ', #

Q2 , ? @ 5+ ?A C 7F 7F AF7 ?7F 6 ?7> 7 G 7 I = ? ? G ?@ 7F57 @> ?A 7F 6=?@ F5+B =B 7F 6 ?7> 7F 2 57> 5+ 6=?@>67 =B G5++ D=f 5 C F5++ +57 =?
C5 G=@ B @ I 7F D 567 6 =B ?=6>+57 =?- 7F57 - I 7F 5 7 B 6 5+ A E ?A =B 7F @ 5 I 7F ?7 =@>67 =? =B 7F E > 7F =>AF 5 C=>?@ ?7 F] ? I>7 7 C ++ I 6=?E ? ?7 7= 6=? @ ?7 7F B 7 D+56 7F 6 ?7> 5 5 CF=+ - 5?@ 7=@ 6> +57 =?
7F BB 67 =B 7F D 567 6 =B ?=6>+57 =?

V >]?=C+ @A =B 7F F 7= =B G5++ D=H ?C 7 ?(> =D @> ?A 7F E ?^
7 ?7F 5?@ AF7 ?7F 6 ?7> E +5 A + I5 @ =?7F =BB 6 5 6= @]?=C?5
7F / 8=?@=? ++ =B = 75+ 7 g BB 6 5 6= @ I 5 ?A =? 7?5++ D=H 5 B> ? F @
I K ? E5 A= ?A I56]5 B5 5 7F H7 ?7F 6 ?7> I 0C @ ?A= ?A I56]7 =7F
5 PV 5?@ I =G =7F D+56 L 575 5 5+ =B> ? F @ D 6 5++ B= 7F +577
D5 7 =B 7F AF7 ?7F 6 ?7> I D5 F 6= @ ? E5 => D5 7 =B K 57 75 ?
56F ?A =E 5 E5 5I+ ?>G I =B 5 5 C ++ 5 I 6577 @ 757 G ?7 ? E5 => C=] >7 7 6F B 7= 7F 8=?@=? ++ =B = 75+ 7 7F57 5DD 5+ G5@ B=
>DD= 7 7= 7F @ BB ?7 E C G5 ?75 ? @ 5 7= 7F I F5E => =B G5++ D=H @> ?A 7F
D =@ C 7F CF 6F C 5 @ 5+ ?A

Q ' F ++ - CF 6F CF ?7 75I+ F @ C > @ C]+ - C 7F 5 A ? 5+ % 57 7F ?@ =B 7F 5 - D> D= 7 7= A E 5?7 566=>?7 =B 5++ 7F I> 5+ 5?@ 6F 7 ? ?A 75] ?A D+56 ?7 6 75 ?7 ?>G 57 @ D5 F C 7F ?7 5?@ C 7F=>7 7F C5++ =B 7F 6 7 5?@ 5+ = C 7F ?7 5?@ C 7F=>7 7F / + I 7 g ' F 5 + ++ - > @ I B= 7F 5 P2) - A5E = ?+ 7F 7= 75+ @ 57F 5?@ 7F @ 57F B =G D+5A> I>7 B =G P2) @=C?7= PQ - C 7F 5 A5D B =G P2 V 7= P2 2 J I=7F 5 ?6+>@ @ - 7F 65> =B @ 57F- ?6+>@ ?A G5++ D=H- 5 D 6 B @ (=G P2) 7= P2 2 5?@ B =G P2 V 7= P2Q2 ?6+> E - 7F ?7 B= / B+=H 5?@ G5++ D=H-g 5?@ B =G P2Q V 7= PVTT ?6+> E G 5 + 5 ?6+>@ @ C 7F / B+=H 5?@ G5++ D=H g ' F ++ 566= @ ?A+ 587I @ @575 =B =G E5+> B= >@A ?A =B 7F B =B G5++ D=H ?7 8=?@=?7 B =G P2) 7= 7F 6+= =B 7F AF7 ?7F 6 ?7> 5?@ I =?@

' F E5+> - F=C E - B= H567 D> D= C ++ I ?7= I @ G ? F @ CF ?7F B=++=C ?A 6=? @ 57 =? 5 I= ? ? G ?@ [
F ++ 6= @ ?=7 5++ 7F @ 57F 75] ?A D+56 C 7F ?7F 5 5 =B 7F ++ - I>7 =?+ 7F= G5@]?=C ?7= 7F D5 F 6+] ?E C =B I> 5+ ?7F D5 F 6F> 6F % ?6 7F @ 57F A E ?7 7F ++ G> 7 5+C5 F5E I ?+= ?7 ?>G I 7F5 ?7F= 567>5++ 75] ?A D+56 O= - =?7F = ?7 F5?@ - 7 C5 5 ?=7 >?6=GG=?7 D 567 6 CF ?7 5 D =?@ @ ?7 8=?@=?7 B= 7F 6= D 7= I 75] ?7 ?7= 7F 6=>?7 B= I> 5+ 5?@ =?7F =7F F5?@ G5? L ?7 5?@ G5? $57F=+ 6 C I> @ + CF 7F5?7 ?7F $F> 6F =B (?A+5?@ I> 5+ A =>?@ >7 7 ?=7D= I+ 7= 5 6 75 ?7F=*5?@ G5? @ 57F 7F C I>7 ?7 =7D+56 7F 6 ?7> 5?@ I =?@
(E ?7 B C 566 D7 7F 6= @ =B 7F @ 57F 6= @ @ 5 5DD =H G57 + 6= 67 7F 65?^ ?=7 I 7 > 7 @ GD+ 6 7+ 7= +@ H567 6=?6+> =?7 5 7 C5 ?=7 =7 +5 A + @ 7 G ? @ I 7F +57 =?7 =B 5 6=>?7 @ 7 67 ?5 G>6F 5 7 C5 ?=7 =7 +5 A + @ 7 G ? @ I 7F +57 =?7 =B 7F I 7F 7= 7F @ 57F +5 A= ?>G I =B D =? 6F B+ 5@>+7 C 6=?7 ?>5++ ?7 ?A ?7= 5?@ 75] ?A >D 7F @ ?6 ?7 8=?@=?7 5?@ ?7] G5?? 5 +5 A ?>G I =B 5@>+7 C B= =? 5 =?= 5?=7F 6=?7 ?>5++ + 5E ?A 7 7 F5 I ?7 65+6>+57 @ 7F57 ?7 P2Q 7F D=D>+57 =?7 C 7F ?7F ++ =B = 75+ 7 C5 T-TTT- 5?@ ?7 PV T- 2 - TT I>7 7 =IE => 7F57 >6F 65+6>+57 =? 65?7 F5E 5?7 5DD =H G57 E5+> =?+ ,?7 PQTP- 7F D=D>+57 =?7 C5 5 6 75 ? @ I 6 ? > 7= I V 2-)
,7 G5 I 5@@ @ 7F57 7F C=G ?7 5 6F / 5?6 ?7 G57 =? g =B +=C 757 5?@ >? @>657 @- C @ 67+ D=? I+ B= 7F 757 G ?7 5 7= 7F 65> =B @ 57F F=>AF 7F C=G ?7 C D =I5I+ A> @ @ ,?7F 757 G ?7 I 7F =D ? =? =B 7F @=67= 577 ?@ ?A 7F =5 = I 7F D= 7 =B >6F =D ? =? - 7F G> 7 F5E 5 A E ?7= G>6F = ?7 F 65 =B @ 57F B =G G5++ D=H- F=C E - 7F C5 ?7 5++ D =I5I + 7 + +5I + 7 7= =7F5?7 ?7 =G =7F @ 5

T 9> 7 5D5 7 B =G 5++ 65+6>+57 =? - 7F ++ 6+ 5 + F=C 7F57 B =G P2) =?C5 @ - 7F =>AF=>7 7F G5 ?@ =B 7F57 = ?7G 5?@ 7F CF=+ =B 7F ?7 H7- E G5? D

=? @ @ ?8=?@=?B =G G5++ D=H L> ?A7F +577 F5+B=B7F E ?7 ?7F= ?7G 7F 5 + @ 57F B ++ I +=C TT =? AF7 =665 =? =?+ 'F 7> ?=B =? 5 -P222 6=? D 6>=> B= 7F G5++? =B 7F ?>G I =B @ 57F - O =?+ - ?7 ++ A I+ CF ? G G I @7F57 7F 7F 5 >66 @ ?A7F57 =B 7F K 57 &+5A> 'F ++ 5+ = F= C7F57 ? I=7F6 ?7> 7F @ 5 F5@5? D @ G 6 6F5 567 - 7F 7> ? =B 6 75 ? 5 I ?A G>6F A 57 7F5? 7F= =B =7F ,? G5? ? 75?6 7F D @ G 6 ?6 5 G5] @ ? =? ' 5 =?+ - 7F 7> ? =B 7F >66 @ ?A 5 I ?A- 5 5 >+ - +=C- I>7 ?=7 >?B \> ?7+ 7F D @ G 6 +5 7 @ =E 7C= = G= 5 5?@ 7F 5DD 5 7= F5E = =66> @ G= B \> ?7+ ?7F AF7 ?7F7F5? ?7F E ?7 ?7F 6 ?7> ?@ @- 7F E5 57 =? =B 7F ?>G I ; 5 5 5 >+ - G= 5I >D7 ? 7F +577 7F5? ?7F B= G D =@

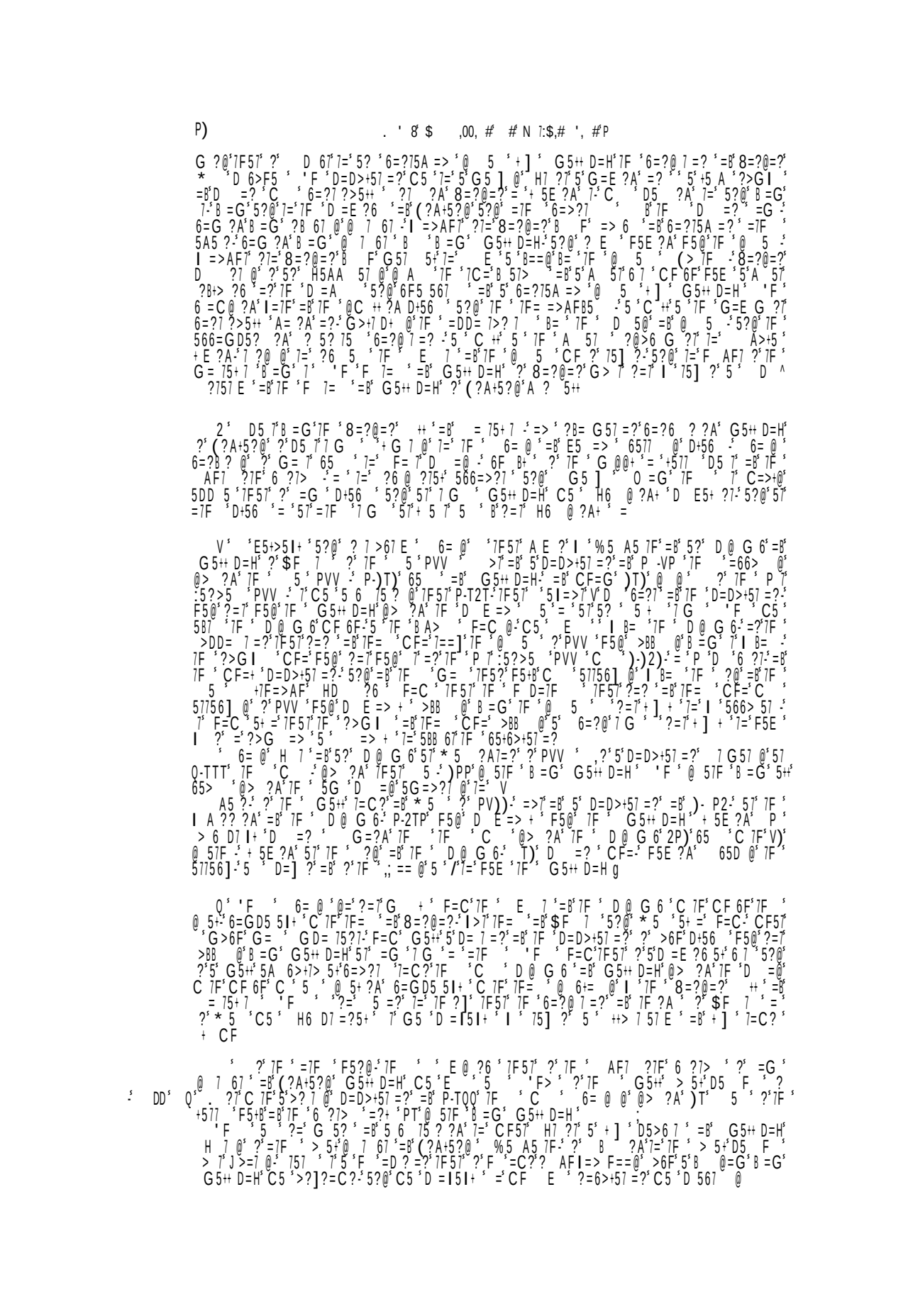
PP * F ?C 7> ?7= 7F GD= 75?7 \> 7 =? =B 7F G = 75+ 7 B =G G5++ D=H- 7F57 7= 5 - 7F D =D= 7 =? =B @ 57F 7= 7F ?>G I =B D =? + E ?A- C 5 G 7 C 7F 7F @ BB 6>+7 =B 7F D=D>+57 =? ?=7 I ?A H567+]?=C? 5+ 5@ 757 @- 7 F5 I ?5 65+6>+57 @ 7F57 7F D=D>+57 =? ? P2Q C5 T-TTT ?7F I5 =B 7F @57>G - 7F 5E 5A 5 + @ 57F 57 =B- = 4 4 B =G - G5++ D=H ? 7F 7 ? 5 5 =>?@ 7F @57 - ?5G + - ? 7F 5 P2QP T- C5 P D 7F=> 5?@ 7F G = 75+ 7 B =G- 5++ 65> =B @ 5 F I ?A) D 7F=> 5?@ 0 G +5 + ? 7F 7 ? 5 PV 2 2 - =? 7F 65+6>+57 =? 7F57 7F D=D>+57 =? ? PV T C5 2 - TT- 7F 5 + G = 75+ 7 B =G G5 + D=H C5 T 7F57 =B @ 57F B =G 5++ 65> D 7F=> 5?@ '5] ?A 7F 5G + 65+6>+57 =? 5 7= D=D>+57 =? C B ?@ 7F57 ? 5 CF ? 7F @ 57F B =G G5++^ D=H C E F AF- 7F G = 75+ 7 B =G G5++ D=H- I=7F ? 7F E ?7 ?7F 5?@ AF7 ?7F 6 ?7> - C5 B \> ?7+ - - - = E ? G= D 7F=> 5?@ (E ? B C 75] 7F 5 ? 7F AF7 ?7F 6 ?7> ? ? CF 6F 7F 7> ? =B @ 57F B =G G5++^ D=H C 7F +=C 7- E f - PVT) PV - PVQ) C ?@- 7 ++ > ?A 7F 5I=E 65+6>+57 =? - 7F G = 75+ 7 B =G G5++ D=H T 2-P) 5?@ ; D 67 E + - 5?@ ? PV V- > ?A 7F 6 ? > =B PQTP- 7F @ 57F 57 C5 T V ?@ ? G= 7=B 7F 5 =B 7F57 6 ?7> 7F G = 75+ 7 B =G G5++ D=H C5 7F ?=7 B5 I +=C - E @ 7 ?67+ 5I=E -) D 7F=> 5?@ ++ 7F G 5? - E CF ? E 5++=C5?6 G5@ B= 7F G 6> 7 =B 7F 65+6>+57 =? - 7F57 7F G = 75+ 7 B =G G5++ D=H ? 8=?@=? C5 - @> ?A 7F AF7 ?7F 6 ?7> - E F AF F 5 I =5@ 6=?6+> =? CF 6F G5 I 6=? @ @ 5 @ B ? 7 + D =E @

) 7 B> 7F 6=?B G @ I 7F ?@ 67 G 5 > =B 7F G = 75+ 7 =B G5++ D=H CF 6F =BB @ I 7F D =D= 7 =? =B @ 57F B =G 7F 65> 7= @ 57F B =G 5M 65> 'F F5 7F E5+> =B I ?A ?@ D ?@ ?7 B 7F 567>5+ D=D>+57 =? 5?@- = B5 5 65? I >@A @- ?=7 E 7 57 @ I 7F 6= @ =B 7F G5:+ D=H @ 57F I ?A ?B+> ?6 @ I 5? 7F ?A CF 6F @ @ ?=7 5+ = ?B+> ?6 7F 6= @ =B 7F =7F @ 57F ? 7F =7F F5?@- 7 E5+> E +5 A + + ? @ I 7F B567 7F57 7F 57 = @ 7 G ? @ 5?@ ?B+> ?6 @ I 6 =>G 75?6 5BB 67 ?A =7F @ 5 5?@ ?=7 G5++ D=H 7 +B 7 G5 - F=C E - F 7 > 7 @ = B5 5 7= F=C 7F57 7F 57 = @> ?A 7F E ?7 ?7F 5?@ AF7 ?7F 6 ?7> C5 E F AF- 5?@- =? 7F CF=+ - F AF @> ?A 7F AF7 ?7F 7F5? @> ?A 7F E ?7 ?7F 6 ?7> O> 7F - B C 5 >G - 5 C= F5E D =I5I+ 7F AF7 7= @= 7F57 7F 7=75+ @ 57F 57 C5 @> ?A 7F= 6 ?7> E F AF- 5 6=G ^ D5 @- B= ? 75?6 - C 7F 7F D ?7 7 G C G5 ?B 7F57 7F @ 57F 57 B =G G5++ D=H C5 E F AF- 5?@ 7F @ 5 7F E B575+ = E D E5+ ?7

' F ++ A E ?= ?B= G57 =? CF57 E 5I=>7 7F ?>G I =B D =? 57756] @ I 7F @ 5 - 5?@ 7F B= 7 56F > ?=7F ?A 5 7= 7F 4 4 =B 7F @ 5 - 7F57 7= 5 - 7F D =D= 7 =? =B @ 57F 7= 7F ?>G I =B =5 57756] @ * + 5 ?- F=C E - I 7F ?= @ ?75+ 757 G ?7 =B E5 => 5>7F= - 7F57 7F B575+ 7 E5 @ E G>6F ?@ BB ?7 5 - 7F57 - ? @ BB ?7 D @ G 6 ? D @ G 6 C5 =B7 ? D=] ? =B 5 I ?A 7F G +@ = G5+ A?5?7 ? =G D @ G 6 - 7F=>AF G5? G AF7 I 57756] @- 7F D =D= 7 =? =B 7F= CF= @ @ C5 G5++ ? =7F 7F @ 5 D =E @ B 75+ 7= 5 +5 A ?>G I =B 7F= 57756] @

 +7F=>AF B =G PV) 0 =?C5 @ 7F ++ A E 7F * % 57 @ 57F- 7F ?>G I F5E ?= I ?5?5+ @ = 5 7= F=C 7F / 5A ?6 @ ?6 g =B 7F G5++ D=H G = 75+ 7 - 7F57 7= 5 - 7F +57 E G = 75+ 7 57 @ BB ?7 5A ?@ 7F ++ B> ? F ?= @575 B= @ 7 G ? ?A F=C >6F ?B+> ?6 5 7F= =B 757 =? ? + B - 5? 75 6=?@ 7 =? - 5?@ =7F 6 =>G 75?6 5BB 67 @ 7F G = 75+ 7

 ' F ++ =B = 75+ 7 B= G- 5 C F5E 5 @- I B5 7F G = 7 6=GD+ 7 => 6 =B =>] ?=C+ @A =B G5++ D=H ? (?A+5?@ ? D5 7 7 G I >7 7 G> 7 I I= ? ?



T' ?' =? ' D 67' 7F ' D =E ?6 ' @ BB @' B =G' 7F ' G 7 =D=+ ' ,?' 8=?@=?-' 5 'C ' F5E ' ?-' G5++ D=H' C5 ' 5+C5 ' D ?'7 @> ?A' 7F ' AF7 ?7F' 6 ?7> ' 7F=>AF' ?' =G ' 5 ' 7F ' @ 57F ' B =G' G5++ D=H' C ' G= ' ?>G => ' 7F5?' ?' =7F -' 5' +5 A ' ?>G I ' @ @' E ' 5 ' E ?' ?'7F ' 5 ' \>=7 @' 5I=E ' 5 ' +@ ?A' 7F ' +=C 7' 7> ? -' 7F ' 5 + ' ?>G I ' =B' @ 57F ' ' 7 ++' 6=? @ 5I+ ' ,?' 7F ' D =E ?6 -' 5 ' ' F=C ?' I ' 6= @' 5?@' ?>G => ' ?6 @ ?75+' 757 G ?7 -' 7F ' @ 5 ' F5@' 5' G= ' @ 7 ?67+ ' D @ G 6' 6F5 567 -' D 6 5++ ' ?' 7=C? ' =7F ' 7F5?' 7F ' A 57' 6 7 ' 5?@' ?' > 5+' @ 7 67 ' ' F> ' ?' 7F ' G5++' D5 F' =B' . +G5 ?=6]' 7F ' 6= @ ' F=C' 7F57' 7F ' G5++ D=H' ') -Q) ' C 5 ' E ' E ' B C' 5 -' I 7C ?' CF 6F' 7F ' C ' ?=' @ 57F ' 57' 5++' B =G') - V ' 5G5++ D=H' = ' E ' B C' =?+ ' % ?6 ' C ' G5 ' 6=?6+>@ ' 7F57' 7F=>AF' ?' 7F ' @ 7 67 ' CF ' B= ' =? ' 5 =?' = ' 5?=7F ' D @ G 6 ' @ @' ?=7' G5] ' 7F ' 5DD 5 5?6 -' 5 ' ?' 7F ' . ?7 F' > 5+' D5 F -' 7F ' G = 75+ 7 ' B =G' G5++ D=H' C5 ' +=C-' 7' CF ' D @ G 6 ' @ @' G5] ' 7F ' C5 ' 7F ' D E5+ ?6 ' =B' G5++ D=H' C5 ' A 57' 5?@' 7F ' -G = 75+ 7 ' B =G' 7' F AF-' 6=GD5 5I+ ' ?@ @' C 7F' 7F57' =B' 8=?@=?

2P' (== @ ' H 7' =B' 7F ' @ 57F ' B =G' G5++ D=H' ?' 7F ' 7 G ' D E => ' 7=' 7F ' ? ? 7 ?7F' 6 ?7> ' ?' 6=>?7 ' =7F ' 7F5?' (?A+5?@ ' 'F> -' ?' 0C @ ?' 6= @ ' B =G' DD'V)' PVV '7=' 7F ' ?@' =B' 7F ' 6 ?7> ' J5?@' I =?@ 'A E ' I=7F' 7F ' D=D>+57 =?' 5?@' 7F ' @ 57F ' +-' DD'PP)' B =G' G5++ D=H' J' F ' 6= @ ' A=' I56] ' 7=' PV -' I>7' >D' 7=' PVV ' 7F ' @ 57F ' B =G' G5++ D=H' 5?@' G 5 + ' C ' ?=7' @ 7 ?A> F @ ' 'F ' F=C' A 57' E5 57 =? ' ?' 7F ' 5 + ' G = 75+ 7 ;B =G' G5++' D=H' ?' =G ' J D @ G 6 ' 5 -' 7F ' G = 75+ 7 ' C5 ' E ' A 57-' A 57 ' E ?' 7F5?' 7F57' =B' 8=?@=?-' 5 ' 65+6>+57 @' B =G' 7F ' ++ ' =B' = 75+ 7 ' ?' 7F ' G5?? ' @ 6 I @' 5I=E ' ' =?' 7F ' =7F ' 'F5?@' ?' G5? ' 5 ' 7F ' G = 75+ 7 ' C5 ' G>6F' +=C ' 7F5?' 7F57' E ' 56F @' ?' 8=?@=?' @> ?A' 7F ' 5G ' D =@ ' ,?' 0C @ ?' 5 ' 5' CF=+ -' 5 ' ?' 7F ' D =E ?6 ' =B' (?A+5?@-' 7F ' (5 ' F5@' 5' E ' G5] @' D @ G 6' 6F5 5=7 ' 0 G +5 ' 6= @ ' +57 ?A' 7=' $=D ?F5A ?' 5?@'K ? E5-' 7F ' +5 7' 56F ?A' I56]' DD ' PTV' 7=' P QT-' 5?@' =7F ' D+56 -' 5++' 6=?B G' 7F ' 6=?6+> =?' 5 ' 7=' 7F ' A 57' D E5+ ?6 ' =B-' 5?@' F AF' G= 75+ 7 ' B =G -' G5++ D=H' ?' *; 7 ?' (> =D ' @> ?A' 7F ' AF7 ?7F' 6 ?7> ' 5?@' 5 +

) ' >7' D F5D ' 7F ' G= 7' 7 +@?A' E @ ?6 ' ?' B5E=> ' =B' 7F ' 6=?6+> =?' ' 7=' I ' ?' ?' 7F ' B567' 7F57' 7F ' 6F5?6 ' =B' 75] ?A' 7F ' @ 5 ' 5?@' =B' @ ?A' B =G' ' C5 ' G5@ ' 7F ' >I 67' =B' G57F G57 65+' 7 57G ?7' I ' @ 7 ?A> F @' G57F G57 6 5? ' =B' 7F ' 7 G ' 'F> ' L5? +' ?=> ++ -' C 7 ?A' ?' PVTT -' 75] ' 5 ' =? ' =B' 7F I5 ' =B' F ' 65+6>+57 =?' 7F ' @57>G' J5 E @' 57' I ' G 5? ' =B' E5 => ' 6= @ ' ?' E5 => ' D+56 ' 7F57' G5M D=H' 65 ' =BB'7F ' 7F 7 ?7F' = ' B=> 7 ?7F' D5 7' =B' 56F' A ? 57 =?' = ' ?' =7F ' C= @ -' 7F57' 7F ' @ 57F ' B =G' G5++ D=H' 5 ' '5I=>7' =? 7F 7 ?7F' = ' =? B=> 7 ?7F' =B' 7F ' @ 57F ' B =G' 5++' 65> ' 'F ' 5G ' 5>7F= ' > ' 5?=7F ' @57>G' =I75 ? @' ?' 5' G +5 ' C5 -' ?5G + -' 7F57' 7F ' AF7F' = ' 7F ' E ?7F' D5 7' =B' 7F= ' 57756] @' @ =B' 7' ' O =G' 7F -' 7' B=++=C ' 7F57' =G 7F ?A' +] ' T' D ' 6 ?7-' =B'7F= ' I= ?' @ @' C 7F=>?' F5E ?A' G5++ D=H' O ?6 ' =B' 7F ' =' @ ?A' ?' 5 +5 A ' ?>G I ' @ @' 57' 5?' 5 + ' 5A -' 7F ' ?>G I ' =B' 7F= ' @ ?A' ?' 5@>+7' 5?@' ?' 5@E5?6 @' 5A ' C 7F=>7' E ' F5E ?A' F5@' 7F ' @ 5 ' * =>+@' I ' G>6F' + ?@' ?' 7F ' ?' -' D =I5I+ -' G> 7' I ' 5@' 7F ' 757 G ?7' =B' %5 A5 7F-' CF 6F' F ' A E ' C 7F=>7' >DD+ ?A' 7F ' @575' =?' CF 6F' 7' ' I5 @-' ?5G + -' 7F57' /' =G ' D =? ' 5 ' ?65D5I+ ' =B' ?B 67 =?' I ' 7F ' G5++ D=H' ' F ' /' D =D= 7 =?' =B' G5?] ?@' 7F> ' H GD7 @' F5 ' I ?' =I E @' 7=' 5G=>?7'7=' ' ?')T'G' ' 7F57' 7=' ' D ' 6 ?7' ' F ' D =? ' F B @' 7=' 5 ' D =I5I+ ' 7F= ' CF=' + E @' 7=' 5?' 5@E5?6 @' 5A ' C 7F=>7' 75] ?A' G5++ D=H-' 7F=>AF' HD= @' 7=' ?B 67 =?' 5?@' D= I+ ' JB= ' %5 A5 7F' C =7 ' ?' 7F ' ?=6>+57 =?' D =@ ' >I 67 @' 7=' ?=6>+57 =? ' F5 7' ?=> M ' F=>+@' > ' @575'+] ' 7F 5I=E ' B= ' 5?' +5I= 57 ' C=] ' 5?@' 7F57' 5'65 B>+' =I E '+] ' %5 A5 7F' F=>+@' G5] ' >6F' 5' 757 G ?7' 5 ' 7F57' 5I=E ' \>=7 @-' GDF5 f ' 7F ' 6=?6+> =?' 5 ' 7=' 7F ' A 57' D E5+ ?6 ' =B' G5++ D=H' ?' 7F ' 7 G ' ?' \> 7 =?

' * ' G5 ' D5 ' ?=C' B =G' 7F ' G ' D E5+ ?6 ' =B' = ' 7F ' G ' G = 75+ 7 ' B =G' G5++ D=H' 7=' 7 ' B575+ 7 ' ?' 7F= ' @5 ' >6F' 6=?7 =E ' F5 ' 5 ?' =?' 7F ' F 5@' ' F ' 7> ? ' B> ? F @' 7=' F G' =B' 7F ' ?>G I ' =B' 65 ' 57756] @-' 5?@' =B' 7F ' ?>G I ' =B' @ 57F ' =B' 7F= ' 57756] @-' @> ?A' D @ G 6 ' ?' E5 => ' D+56 ' ?' (?A+5?@' 5?@' G 65-' F=C @' 5?' 5E 5A ' 7 ' =B' B575+ 7 ' =B' P2 ' D ' 6 ?7-' 5G=?A 7' 7F= ' 57756] @ ' 'F -' CF 6F' @=' ?=7' @ BB ' G>6F' B =G' 7F ' @57>G' GD+= @' I ?=> ++ -' F5 ' I ?' D>7' B= C5 @' I ' G5? ' 5 ' I ?A' 5I=>7' 7F ' ?57> 5+' B575+ 7 ' =B' G5++ D=H' @> ?A' 7F ' PQ7F' 6 ?7> ' 7' F5 ' I ?' > A @' 7F57' 7F ' @ 57F ' =B' 7F= ' @ ?A' >?@ ' 7C=' 5 ' =B' 5A ' C ' H6+>@ @' B =G' ' > ?-' 757 7 6 -' 5?@' 7F57' 7F ' G> 7' F5E ' + @' 7=' 7F ' =G =?' =B' G5? ' @ 57F -' 5 ' 7F ' G = 75+ 7 ' ?' 7F57' 6+5 ' C5 ' F AF ' 'F ;@ ?6 ' + @' = ?7=' F=C' 7F5' 65

>?@ 7E = 5 =B 5A C H=+>@ @ 6 75 ?+ 65??=7 I A5 @ @ 5 75I+ F ?A 7 , 7 7= I = E @ 7F57 5+7I=?AF 7F 5E 5A B575+ 7 ?CF57 5]?=C?5 :> ?;= 5 C5 =?+ P2 D 6 ?7 -7F B575+ 7 ?7F E5 => D@ G 6 B =G CF 6F7F= 757 7 6 C 6=GD + @ E5 @ A 57+ -5?A ?A B =G PT 7=2 D 6 ?7 'F 5 ? 75?6 CF 7F B575+ 7 F5 I ?E ?+ 7F5?PT D 6 ?7 F5 I ?5+ 5@ G 5] @-7F B575+ 7 =B G5++ D=H @ BB @E A 57+ ?@ BB ?7 D @ G 6 ?=> ++-?75] ?A 7F 5E 5A B575+ 7 \>=7 @5I=E -G 5] =?7 A 57 E5 5I +7 -7G5 I 5 F AF 5 P ?7 J5?@ ?@ @ 7 ++ F AF >+7 F5E I ?6= @ @ - = 5 +=C 5 P ?T ' F 6= @ =B 7F 8=?@=?7 0G5++ &=H %= D 75+ B =G PV 2 7= PV2 F=C @5 B575+ 7 =B) D 6 ?7 -5?@7 F5 I ?7 57 @7F57 @> ?A 7F +5 7) 5 =B 7F +5 7 6 ?7>)D 6 ?7- =B 7F= 5@G 77 @ >66>G I @7=7F @ 5 ,?7F ++=B = 75+ 7 =B 7F 7=C?7 =B 7F * 5 ?A7=?7 B= 7F 5 PVV -I 7F (E :] ?-6=GG>? 657 @ I L & = E5+7=7F (= 5+ 0=6 7 =B 8=?@=?- 7 7 57 @ 7F57 ?=?7 AFI=> F==@- =?7 =B) CF=5 F5@ 7F @ 5 P) J7F57 7=5 - & D 6 ?7 @ @ % 757 -B> 7F -7F57 ?=7F ? AFI=> F==@ 7F B575+ 7 C5 7 ++ A 57 -5?@ 7F57 F 5@ 5 =?7=I + E 7F57 7 C5 ?=7+ =?7F CF=+ F 65?I ?=@ @=>I7 7F57 7F B575+ 7 =B G5+ D=H @ BB @E A 57+ ?@ BB ?7 D @ G 6 0=7 A 57 5 7F 5E 5A I ?A 566 D7 @5 F=C ?A CF57 G5 I 65++ @7F ?= G5 = ?57> 5+B575+ 7 ,7 G>6F G= GD= 75?7 7=I 5 ?G ?@ 7F57 7F B575+ 7 @ BB @ C @ + =?@ BB ?7 =665 =?

9) -0) -
. +G5 ?=6]=B 7F 2)) @ 57F =66>+ ?A 7C ?PV)Q 5?@ PV2 -7F 5A =B ? ? ?=7
I ?A A E ?-=?+ E ?C =B 7F= 5I=E PT 5 F I> 5+ A 7 B= 7F
2 DD 2) A 5E 5 @ =B 0 7 $>7F 7 ;-5?=?A57 -5?@ >6=+ >6F 07 7- (@ ?I> AF- F=C 7F57
@> ?A 7F 5 PV2 Q -7F D =D= 7 =?7 =B @ 57F B =G G5++ D=H =B 7F= I +=C 7F
5A =B 7 ?7 5 -7=7 E 7F=> 5?@ @ 57F B =G 7F57 @ 5 57 5++ 5A -C5 ,?@ @ ?7 5++ 6= @ =B D @ G 6 ?7 CF 6F7F 5A 5 A E ?-7F G= 75+ 7 C5 G5 ?+
5G=?A 7 ?B5?7 7 5+ =?7 ?7F +5 A 6= @ -6=E ?A D =@ ?6+>@ ?A I=7F
P DD V2 D @ G 6 5 5?@ 5 CF 6F C ?=7 D @ G 6 5 ?7F= =B K ? E5 JP QT
PV2T -CF 6F F=C 7F57 7F B 57> C5 5DD5 ?7 5 + 7F5?7F AF7 ?7F6 ?7> -?7F= =B OC @ ?JPVV PQTT 5?@ ?7F= =B 7F D+56 ,?6 @ ?75+ B ?6 ?E5 => C 7 ?A F=C 7F57-7F B567 C5 6=A? @ 57 7F 7 G 7F > %5 A5 7F =I E 7I57 ?7 $F 7 ?7F 5 PVV) PVVV-=B 7F= >?@ PT 5 -/F5+B 5 /G5? @ =B 7F G5++ D=H 5 =B 5++=7F @ 5 g 5?@7F B 57> =B G5++ D=H 5 >G @ ?7F 6+6>+57 =? =B ?=>++ B @ 7=5I=E

'F B 7 \>5 7 =B 7F P 7F 6 ?7> 6F5 567 @ ?7 F 5?@ =7F 6=>?7 I 5 7] ?A @ 6 5 =B G5++ D=H

2 ,?7F 8=?@=?7 ++ =B = 75+ 7 7F 7 7> ? =B G5++ D=H B= 7F 5 PQTT 5)-T 'F C5 7F +5 7 7> ?7 =?F 5 F 5)-TTT & =G 7F ?6 =?C5 @7 F ?>G I =B @ 57F B =G G5++ D=H B ++- D 6 5++ 5B7 PQPT- 56F ?A ?7 PQPQ =++=C 5 B A> 5)P 7F B5++ I ?A A>+5 5?@ G5] @ I D @ G 6 5 ?7 P-QP) PQPV- 5?@ PQ 'F @ 6+ ? 5++7F G= 7] ?A ?6 @> ?A 7F D =@7F D=D>+57 =?7 =B 8=?@=?7 C 7F ?7F + G 7 =B 7F ++ - ?6 5 @ B =G V 2-) ?PQTP 7=P-PQT-) ?PQ P F5 I ?7 5+ 5@ > A @ 7F ++ C GD B 67- 5?@ 7F A =>?@ B= I + E ?A 7I57 @> ?A 7F \>5 7 =B 7F 6 ?7> 7F GD B 67 =? C A 57 7F5?7 ?B= G 7 G ' F 6=?B G @ I 7F B567 7F57 7F 7> ? =B 7F 7=75+ @ 57F - ?D 7 =B 7F ?6 5 @ D=D>+57 =?- C =?7F CF=+ ?=7 A 57 - ?G5? 5 E ?+ - 7F5?7 ?7F D 6 @ ?A 6 ?7> 5] ?A E 5++=C5?6 B= 7F BB 67 =B GD =E @ 5? 75 6=?@ 7=?- 7F B 57> =B 7F 7> ? G5 I 75] ?7 5 E @ ?6 =B 7F GD B 67 =? 7 Q7 ++- ?D 7 =B 7F GD B 67 6F5 567 -7F ++ F=C 7F57 @> ?A 7F \>5 7 =B 7F 6 ?7> -5 7] ?A 6F5?A 7==] D+56 ?7 G5++ D=H ?7 8=?@=?

V @ \>57 6= @ =B 7F D E5+ ?6 =B 5?@ G= 75+ 7 B =G G5++ D=H ?7 D5 7 =B (?A+5?@ =7F 7F5?7 8=?@=?- @> ?A 7F B 7) 5 =B 7F ? ? 7 ?7F

6 ?7> -5 ?=7 5E5 +5I+ I>7 7F57 ?7F D =E ?6 -5 ?7 8=?@=?-5 5 E A 57 6F5?A F5@75] ?7D+56 F=C?I 6=GD5 ?A7F 6=?@ 7=?75 A5 @ G5++ D=H =8 7=C? 57-= 7=C5 @ 7F ?@7 =B-7F D =@C 7F7F57 =8 7=C? 7@> ?A7F +5 7 6 ?7>

?7 $5GI @A -* 7F5 7=75+D=D>+57 =?=8P -P)?7 PQ)P-7F ?>GI =8D =? CF=->D7=7F >GG =8PQ)2-F5@F5@G5++ D=H@> ?A7F D 6 @ ?A7) 5 C5 -2T-= 5I=>7) D 7 6 ?7 F B A> >+7 B =G7F 5? C A E ?7 7=?\> ?7 5 F=> 7= F=> E 757 =?-5?@I ?A@ D ?@ ?7 =?7F G G= =8 7F= ?7 =A57 @ 65?5 F5E =?+ 5?5DD =H G57 E5+> = =E -7F =8 6=> =G 7 5M CF=-F5@5 G5M D=H5?7 = 7=-7F) 5 ?7F 7=7F F5?@-5 E D @ G 6=8 G5++ D=H 7==]D+56 ?$5GI @A ?PQ) -5?@7F @ @>67 =?=8 7F 2Q2=5 =8 7F57 D @ G 6 B =G7F ?>GI 5I=E -@>6 7F D 6 ?75A 7=-5I=>7)T 'F D=D>+57 =?7 I= ?@> ?A7F 7F 5I=E) 5 5G=>?7 @7=-Q-PP) =8 7F D 6 ?7-F5@F5@G5++^ D=H-P)V D 6 ?7-I ?=6>+57 =?

?$F 7 -=8CF 6F D E => G ?7 =?F5 I ?G5@ -C 7F5 5 D=D>+57 =?7 ?PVV 5+G=7 7F 5G 5 7F57 =8$5GI @A ?PQ)P-E f-P -VP -I 7F P 7:5?>5 PVV 5++I>7 P-T2T-7F57 5I=>7 D 6 ?7-F5@F5@G5++ D=H57 =G 7G =7F 'F 5 PVV C5 G5] @I 5 E D @ G 6 =8 G5++ D=H-7F ?>GI =865 I ?A P-)T) F ?6 =8 7F D=D>+57 =?=?7F P 7:5?>5 PVV -5++I>7)-)2)- = 5I=>7Q D 6 ?7-F5@F5@7>5++ D=H

A5 ? ? * 5 ?PV))-=8CF 6F G ?7 =?F5 5+ = D E => + I ?G5@ -=8 5 D=D>+5 +=?=8)- P 5++I>7 T)-= 5I=>7Q)D 6 ?7-F5@F5@G5++ D=H ' F57-5A5 ?-C5 5B7 5? D @ G 6 8 2P) =5 = 7F57F D 6 ?75A I B= 7F D @ G 6 C5 5I=>7 2

L575- G= B 5AG ?75 -H 7 6=?6 ? ?A#= C 6F ?PQ)T-CF 6F 6 7 C 7F 5 7F ?D=D>+57 =?=8 5I=>7B= 7 7F=> 5?@F5@F5@ D @ G 6 =8 G5++ D=H ?PQT -? PQTV -?PQP -5?@ ?PQPQ 7F +5 7 I ?A E -7F @ 57F B= 7F 5 PQP I ?A T-5 G= 75+ 7 =8 5I=>7 P D 7F=> 5?@ $ = ? ¼4 F 8# & # * Q 757 7F57 E 7 ?A TT B5G + -C 7F P- VV D =? ?>?@ 7C ?7 5 =8 5A -F 8=>?@7F57 VP J= G= D =I5I+ 2Q F5@F5@7F @ 5 @> ?A7F 6 ?7 D @ G 6-5?@ Q-= 5I=>7)2 D 6 ?7-F5@F5@7F 5 + % B> 7F 757 7F57 =8 2T D =? -B= G ?A7F PP) @ BB ?7 B5G + ?CF 6F 7F) TT 65 =8 G5M D=H CF 6F 65G >?@ F ?=7 6 @> ?A7F D @ G 6 =66> @- V J= =>AF+ VD D 6 ?7 F5@F5@7F G5++ D=H57 =G 7G = =7F B 7F) V J= 5I=>7 2T D 6 ?7 I5@F5@7F @ 5 D E => 7=7F D @ G 6 #= G ?7 =?=8 5A G5@ ?7F +577 757 G ?7-5?@ 7F B= G 757 G ?7D =I5I+ A E 5G= 6= 67 @ 5 =8 7F A ? 5+6=?@ 7 =?=8 7F 6 7 ,B =#= C 6F @@?=7@ BB 5 7=? ?A5 @ 7= =8 7F 6 7 =8 7F 6=?@ 7=?7 5 7 6=?7 5 7 7= $F 7 -?=7 =7] ?A5 =? -I>7 7 +7 ?7>67E -?6 #= C 6F ?7F B 7 \>5 7 =8 7F D ?7 6 ?7> -+] $F 7 ?7F +5 7 6 ?7> -@B =G E D @ G 6 =8 7F @ 5

Q 'F @5?5=8 7F 7C= D=6F 5 ?=7 H567+ 6=GD5 5I+ 7F=>AF- B =G CF57F5 I ?7 757 @6=?6 ?A7F 5A ?6 @ ?6 =8 G5++ D=H ?7F 5 ?@ $F 7 5?@ * 5 F5@ D =I5I+ F5@ G5++ D=H C 7F ?7F D E =>) 5 = =E -7F @5?5 ?5? 65 5 5DD =H G57 E =?+ O7 ++- G5] ?A E 5++=C5?6 -7F 6=?7 5 7 I 7C ?7F 7C= D=6F 6=?B G 7F 6=?6+> =?5 7=7F @ 6+ ?=8 G5M D=H ?7F D =E ?6 ?7>67 =8 G5M D=H ?7F D =E ?6 ?7F 6 ?7>

B + 5E ?A (?A+5?@C 7> ?7=7F 6=>?7 -7=OC @ ?B= ? 75?6 -?CF 6F 2 DD V 5 F5 I ? ? 6= @ G= H567 7F5?7F= ?A+5?@ H 7-7F 5G G5] @ 6F5?A 5DD5 ?7-?@ @ 7 ++ G= 6+ 5 F5 5+ 5@ I ? 757 @-7F 5G++ D=H G= 75+ 7 ?OC @ ?B =G PVV 7= PQTP C5 E F AF- 6=GD5 5I+ 7=7F57 =8 8=?@=?-7F=>AF G= 7 =?A+ G5] @I D @ G 6 E5 57 =? ' F 757 =8 7F ?A &&%4 F=C? 5 B5 I56] 5 PV -I>7 + H567+ =?566=>?7 =8 G 5 + 5?@ G5++ D=H I ?A 7> ? @ >?@ 7F 5G F 5@ I 7C ?PV 5?@ PVV ,?PQTT-5 A 57 D @ G 6 5 -7F G= 75+ 7 C5 =E D 7F=> 5?@-5?@ 7F 5 + 5E 5A =8 7F D =@PVV PQTP C5 =E) D 7F=> 5?@ O =G PQT+ =?C5 @ 7F 5 B5++- I ^ 6=G ?A A 57 5B7 PQT =7F 5 + 5E 5A 56F ?A P D 7F=> 5?@ ?@ @-?-?=? 5 =?+ - PQT -B5++ ?A 5B7 PQP2 =B7 ?I +=C +D 7F=> 5?@ 5?@-?@ @-?-?=? 5 56F ?A T T D 7F=> 5?@-I>7 ?A 5A5 ?7=? 5 + T D 7F=> 5?@ ?PQ)

2T G +5 6F5?A F=C? I 7F H567 6= @ =8 $=D ?F5A ?CF 6F P- DD 56F I56] 7= PV T OG5++ D=H C5 D E5+ ?7 >D 7= PQTP-7F ?>@@ ?+ @ 6+ ? @- =V Q

(! 8 $,00, # # N $$,# ', #

,?@ @ B= 5 CF + 7 \> 7 @ 5DD 5 @- ?=@ 57F I ?A 6= @ @ I 7C ?7F 5 PQPT 5?@ PQ) a

2P ?@ 5 G +5 6F5?A ?@ 6= @ 5 5 5E5 +5I+ +57 ?A 7= 7F 6=>?7 =B * 7 ?(> =D 5?@ 7= 7F M? 7 @ O757 ,?5++ =5 7F B 7 \>5 7 =B 7F ?C 6 ?7> G5] @ I 5A 57 @ G ?>7 =?=B G5++ D=H J+ 57F

2) * F57C5 7F 65> -= CF57C 7F 65> -= B 7F G5] @ @ 6+ ? =B G5++^ D=H ?7F B 7 \>5 7 =B 7F ?? 7 ?7F6 ?7> * 5 7 @> 7=7F ?7 =@>67 =?=B E566 ?57 =?- = 7 7=7F C HD+5 ? @

2 ? B & =7 =B 7F ?7 =@>67 =?=B E566 ?57 =?C5 5 E A 57@ 6 5 ?7F D 567 6 =B ?=6>+57 =?-CF 6F F5@ I 6=G E D E5+ ?7@> ?A7F +57 D5 7=B 7F D E =>6 ?7> ?@ 7F E C F5 I ?D>7 B= C5@ 7F57- 7F D E5+ ?6 =B ?=6>+57 =?F5E ?A A 57+ ?6 5 @ 7F 5G=>?7 =B G5++ D=H- 7F @ G ?>7 =?=B G5++ D=H ?\> 7 =?C5 7F >+7 =B 7F @ 6 5 =B ?=6>+57 =?

2 'F D 567 6 =B ?=6>+57 =?B= 7F G5++ D=H- 7F57 7F 5 7 B 6 5+ ?7 =@>67 =?=B 7F E > ?7= 7F 7 G I 7F ? 7 =?- =B B+> @ B =G 5 E5 =+=> D> 7>+ ?7=C=>?@ =B 7F] ?G5@ B= 7F D> D= -I A5?@ B ? 7 + ?(?A+5?@ 7=C5 @ 7F ?@ =B 7F B 7 \>5 7 =B 7F AF7 ?7F6 ?7> 77 ?7 =?C5 @ 67 @ 7= 7F G577 I + 77 B =G ' G=? =B 7F ? J@57 @ PVP 5?@ & +5 ? -D>I+ F @ ?7F) 7F E=+>G =B 7F &F += DF 65+ ' 5? 567 =? JPVP2 -5?@ D 6 5++ I 5+ ?B =G 8 5@ 5 * = 7+ =?75A> ?PVPV ' F=>AF7F 5 ?@ 657 =? 7F57 ?K+ 57 75 ?5?@ +5?@-5 ?=7F 6=>?7 -G = 7 =B ?=6>+57 =?F5@ =665 =?5++ I ?D 567 @ 57 5G>6F 5 + @57 -7F B 7 6+ 5 + 6= @ @ 65 ?(?A+5?@ 7F57=B7F @5>AF7 =B 85@ 5 * = 7+ =?75A> JCF= =?F5@ =G 7 G I B= I ?=6>+57 @ 57 $=? 5?7?=D+ -?=6>+57 @ I 5 7+5?@-5 ?8=?@=?-?8=?@ D +PV)P 7F 65 ==?B=++=C @ ?(?A+5?@-5?@5I=>7 7F 5G 7 G 7F 5 D 567 6 C5 5+ =?=@>6 @ ?=7F 6=>?7 =B * 7 ?(> =D -5?@ ?7=7F M? 7 @ O757 =B G 65-?5G + -57 = 7=?-

2 ,?C5 B=>?@ 7F57 7F 57756] ?@>6 @ I ?=6>+57 =?C 5 5 5 >+ G +@ -5?@ E G>6F+ B575+7F5?7F 57756] =B 7F I?57> 5+G @ 5 -7F B E 5?@ 6=? 7 7>^ 7 =?5+@ 7> I5?6 I ?A+ 5?@=B F= 7 @> 57 =?-5?@-7F >D7 E D> 7>+ G>6F B C 7F ?>G I =B 7F E5 @- I ?A 6=GG=?+ 5 @=f ?= 7C=- =G 7G =?+ 7C= = 7F -=G 7G 5 F>?@ @= =G= ?= =G =5 7F C5 ?=- >D7 =?5 5++- 7F BB 67 I ?A + G 7 @ 7=6=? 7 7>7 =?5+' @ 7> I5?6 5?@ 7=-6F5?A ?7F C=>?@ =B ?=6>+57 =?7F G +E 7C5 G5 ?75 ? @ 7F57 ?= >6F =5 7F @ 5 F5@ 5++ I ?75] ?-5?@ GG>? 7 5A5 ? 7 5 >I \> ?7 57756] 6> @-5 ? 5 =B ?57> 5+ G5++ D=H = =B ?=6>+57 @ G5++ D=H G5? B 7 ?A 7 +B ?5? >D7 =?=B D> 7>+

22 ,?(?A+5?@7F D 567 6 =B ?=6>+57 =?57 7 ?7 =@>67 =?- 7F=>AF G>6F +5>@ @ 5?@ 7 =?A+ > A @ I =G -C5 I 77 + =DD= @ I =7F = =E -7F ? 7 5+ 7F> 5 G ?B5E=> =B 7 ==?@ 6+ ? @-=7F57 ?7F 5 PV T T E +77+ ?=6>+57 =?G 7=F5E I ?D 567 @ I=>7 PV T-F=C E -5 E E5+ 5DD 5 7=F5E 75] ?D+56 ?PV 2 5?-?=6>+57 =?5?@ QG5++ D=H %= D 75+C5 75 7 @ ?8=?@=?5?@ @> ?A7F CF=+ =B 7F +577 F5+B =B 7F AF7 7F7 6 7> 7F D 567 6 G5 I 5@ 7=F5E I ?E A ? 5+ ,7C5 D 6 5++ = @> ?A 7F +5 7 \>5 7 =B 7F 6 7> -7F ?6 5 I ?A 57+ 5 7 +5 A + @> 7=7F /GD =E @ G 7F=@ g =B ?=6>+57 =?- ?7 =@>6 @ I =? 0>77=? ?PV2 -5?@]?=C?5 /7F 0>77=? 5? /G 7F=@ g

2V 'F G 7F=@-65 @=>7I 0>77=?F G +B5?@F G GG @ 57 5 =6 57 -5 5 C +5 ?5 G= + G=@ B @ B= G I L G @5+ 5?@ =7F -F5@ B= 7 =I 67 7F 6> ?A 7F5 7F 57756] ?@>6 @ I ?=6>+57 =?-CFM G5 ? ?A 5 E 75I+ 57756] =B G5++ D=H 5?@ =I ?A ?A GG>? 7 5A5 ? 7 B>7> 57756] -F=>+@ I 5 G +@ 5 D= I+ 7F5 7 6=? 7 7>7 =?5+@ 7> I5?6 F=>+@ I + AF7 5?@ =B F= 7 @> 57 =?7F5 7F 6> ?D7 E D> 7>+ F=>+@ I B C-= E ?5I ?7 5+7=A 7F 5?@ 7F5 B575+ > -7F =G CF57B \> ?7 =66> ?6 =B CF 6F F5@ ?7F 5 + @5 I ?5 A 57 =I 756+ 7=7F D 5@=B 7F D 567 6 -F=>+@ I ?@ @ 57+ 5 7 E 5 m?@ @-B ?=7 GD= I+ =?6 G ?A 7F ?7 5+ =B 7F G 7F=@-CF 6F 0>77=? 577 GD7 @ 7=] D 5 6 7-7F F5 I ?G>6F @ 6> =?7F G =7 F5E 6=? 7 @ D5 7+ ?5

D =D 65 = A G ?=8 7F D57 ?7 I B= -@> ?A-5?@5B7 7F ?=6>+57 =?-D5 7+ ?7F G=@ =8 ? 7 ?A7F E > -5?@D5 7+ ?G5] ?A> =8 7F B+> @=8 7F E5 =+=> E 6+ 57 5 +57 E + 5 + 75A

KQ ' F 65?I ?=-@=>I7 7F57 I 7C ?7F 5 PVVT PVQT ?=6>+57 =?C5 E C @ + D 567 @ ?7 (?A+5?@-5?@7F ?=-E @ ?6 7=- F=C7F57 5? G5] @ @ 6+ ? ?7F D 567 6 7==] D+56 @> ?A7F G5 ?@ =8 7F 6 ?7> >7 7F @ 7 I>7 =?=8 7F D 567 6 C5 E >? \>5+ ,7 C5 G>6F G= 6=GG=?7 5G=?A7F 7F 6F-= 57 + 5 7-5G=?A7F C ++ 7= @=-7F5?7 5G=?A7F D== -7F=>AF G5? I ? E=+ ?7 BB= 7 C G5@ /7=- H7 ?@7 7 5@E5?75A @ 7=- 7F F=G =8 O>77=?7 55@L G @5+ -5?@7 ?7 !=] F -7F D 567 6 C5 E C @ D 5@ ?7F =7F F5?@-D5 7 =8 ?7 5?@ O> H5 \>=7 @8 F %5 A5 7F7 ?PV 5 F5E ?A I ?D 567 65++ B =G ?=6>+57 =?-5?@ G +5 757 ^ G ?7 5 7=- 7F D5>6 7 =8 ?=6>+57 =?7 7F =7F57 @ 7 67 5 G5@ I =7F C 7 =8 5I=>7 7F 5G D =@ 'F 5 ?=- 6= @ A E ?A H567 ?B= G57 =?5 7=-7F 5G=>?7 =8 ?=6>+57 =?D 56^ 7 @ ?8=?@=?-I>7- ?A7F57 7 C5 B5E=> @ I 7F 6F-5?@7 7F57 =?7F =7F 5?@ =DD= 7>? 7 B= 7F D== C 5BB= @ @ I 7F ?=6>+57 =?%= D 75+-C G5 - D F5D -6=?6+>@ 7F57 7F D 567 6 C5 57 + 5 7 E A ? 5+

2 * F57 ?B+> ?6 -7F ?-F5@ 7F D 567 6 =?7F D E5+ ?6 =B-5?@=?7F G= ^ 75+ 7 B =G-G5++ D=H-@> ?A7F +577 F5+B-5?@ D 6 5++ @> ?A7F +577 -\>5 7 =8 7F AF7 ?7F 6 ?7>

VT 0 ?6 5? ?=6>+57 @ D =? C5 ?B 67 => -56F ?=6>+57 =? C5 5 => 6 =B @5?A 7=-7F= -?=7 D =7 67 @ I 5 D E => 5 7756] CF= 65G ?7= 7F 6=GD5? =B= E ?7 5 -7F ?=6>+57 @ D =?@> ?A7F 7 5756] 5?@7F @5?A C5 ?6 5 @ I 7F B567 7F57 7F G +@ 6F5 567 =B 7F ?=6>+57 @ @ 5 D G 77 @- ?G5? 65 57 + 5 7-7F D57 ?7 7= G=E 5I=>7 5G=?A F B ++=C = =E -5 %5 A5 7F- F G^ +@ 5 f 5+=> 5@E=657 =B ?=6>+57 =? ?5 7 G57 6 A>+57 @ G5?? -D= ?7 =>7-7F I ? B 6 5+ >+7 =B ?=6>+57 =?F5@ =II @7F @ 5 =B 7 7 = 7=- =A 57 5?I H7 ?7 7F57 7F 6F5?@D=C B>+?=+=?A G5@ 7F BB= 7 CF 6F7F B= G + @ @ 7=D E ?7 7 ?7 5?6 ?7=- = 7 D 5@?-7F ? AFI=> F==@-5?@7F> B5E=> @ 7 D 5@5G=?A7F >?D =7 67 @D== =-7F57 ?=6>+57 =?/7F=>AF G ? ?7+ >B>+ /7=-7F 6F5DD 5 @7=I 7 > => 7=-7F D== g @@ ?A-7F B= -7=A 7F 7FD 5 =B ?=6>+57 @ G5++ D=H-5?@7F 65 =B ?57>5+ G5++ D=H=B CF 6F7F 6 ?=6 -+57 @ 65 C ?=?C5 =-=7F 7F 65> -7 G D =I5I+ 7F57 ?=6>+57 =?@ @I d ?@7=-?6 5 7F #@ =B G5++ D=H I>7 7F 5 ?=- 6= @ @ @5?5 7=- F=C 7F57 7F 5++ C5 7F 65 -5?@7F >DD= @ ?B+> ?6 G5 F5E I ?6=>?7 ^ I5+5?6 @ I =7F ?B+> ?6

VP ' F E @ ?6 5 7=-7F ?B+> ?6 CF 6F ?=6>+57 =?F5@ =?7F G= 75+ 7 B =G G5++ D=H ?7 G5? D 67 6=?B+ 67 ?A %5 A5 7F-7F=>AF F 5@G 7 7F57 ?=7F D5 7 =B 7F] ?A@=G 7F D 567 6 G5 F5E 5E @ G5? + E -C5 D >5@ @ 7F57 ?F =C?D5 7 =B (?A+5?@5?@ * 5+ 7F @ 57F I 7F G5++ D=H F5@ I ?5>AG ?7 @ I 7 5?@ F D=?7 =>7 7F57 ?8=?@=?-K ? E5-5?@ =7F /7=C? ?/ @ BB ?7 7>57 =? 5?@ 6 6>G 75?6 7F G= 75+7 B =G 7F @ 7 GD F5 /?6 5 @ ?6 7F ?7 =@>67 =?=B ?=6>+57 =? g 0 E 5+ C 7 ?7F +577 D5 7 =B 7F +5 7-5?@ 7F 5 + D5 7 =B 7F D ?7-6 ?7> F +@ 5 G +5 E C 7F C 7 -5A5 ?-=DD= @7F E C

h

V) >6F > F5 I ?G5@ =B 7F 8=?@=?++ =B = 75+ 7 5 I 5 ?A=?7F \> 7=? 'F -5 F5 I ?D= ?7 @ =>7- G 7=- F=C-?D 7 =B 5M 7F GD B 6^ 7=? -7F57 7F G5++ D=H G= 75+ 7 ?8=?@=?C5 A 57 @> ?A7F AF7 ?7F 7F5?@> ?A7F E ?7 ?7F =?7> 5?@ 7 F5 I ?> A @7F57 7F ?6 5 C5 -?D5 7 57 + 5 7-= E ?+5 A + -@> 7=- F ?7 =@>67 =?=B ?=6>+57 =? 'F E 5+ \>5 7 =B 7F PQ7F 6 ?7> ?@- ?D 67 7=-7F D= ?7-7=- I @ ^ 7 ?A> F @ L> ?A7F B 7 \>5 7 7F C5 -I =5@+ D 5] ?A-?=- ?=6>+57 =? 57 5++ 7F B C 65 B =G PV)P 7=-PV) G5 I ?A+ 67 @ L> ?A7F 6=?@- \>5 7 7F E5 E +77+ ?=6>+57 =?-7F D 567 6 ?=7 I A ?? ?A 5++ 7=- ?6 5 >?7 + 5B7 PV T L> ?A7F 7F @ \>5 7 7F D 567 5D @+ ?6 5 @-6>+G ?57 ?A C 7F 7F ?7 =@>67 =?=B 7F O>77=? 5?7 G ?PV2 ?@7F A 57 D E5+ ?6 =B 7F D 567 6 5DD 5 7=-F5E 6=?7 ?> @-@> ?A7F CF=+ =B 7F +5 7 \>5 7 %5@ ?=6>+57 =? I ?7F G5?-65> -= E ?5 +5 A 65> -=B 7F ?6 5 =B G= 75+ 7 @> ?A 7F AF7 ?7F 6 ?7> -7F ?6 5 'C =>+@ I HD 67 @ ?=7 7@ I =3

D =G ? ?7 >?7 +5 5I=>7 7I 5 G @@+ =8 7F = =?> 7 7= 5D @+ 5 @> ?A 7F 7F @ \>5 7 52@ 7=I G= = + 757 =?5 @> ?A 7F +5 7 \>5 7 ?7 7F 6=?7 5 CF 7F 7F E 7 =8 7F @ 5 I >@A @ I 7F 7 7=75+ @ 57F 6= @ @ ?7 7F ++ = I 7F D =D= 7 =?=8 G5++ D=H @ 57F 7 7=@ 57F B =G 5++8 65> = I 7F G= 75+7 65+6>+57 @ =?7 F > DD= @ ?>G I =8 ?F5I 75?7 = I 7F +57 E E 7 B \> ?6 =8=66> ?6 52@@> 57 =?=8 7F D @ G 6 >6F ?6 5 5 7F ++ F=C ?7F E 7 =8 7F @ 5 @> ?A 7F B 7 \>5 7 CF ?7F C5 =+ 77+ 5 5 G5] @5 = G= G5] @ 7F5?= @> ?A 7F +577 \>5 7 CF ?7F =?=6>+57 =?C5 E 7 =8 7F @ 5 @> ?A 7F 6=?@ \>5 7 CF ?7F C5 E 7 =8 7F @ 5 @> ?A 7F B 7 \>5 7 CF ?7F C5 =+ 77+ 5 5 G5] @5 = G= G5] @ 7F5?= @> ?A 7F +577 \>5 7 CF ?7F =?=6>+57 =?C5 7F G5 ?= 5 +5 A 65> =8 7F A 57 G= 75+ 7 B =G G5++ D=H ?8=?@=?@> ?A 7F AF7 ?7F6 ?7>

V ,7 G> 7 I = ? G ?@ 7F57 ?=6>+57 @ G5++ D=H C5 =?7F CF=+ G>6F + B575+ 7F5?7F5?7?57> 5++ 56\> @ F 6+5 =8 ?=6>+57 @D =? G5 7F> F5E 6=?7 I>7 @ +7=7F B575+=5 =8 G5++ D=H7F5?8 7F F5@I ?+ B77=7F 6F5?6 =8 ?57> 5+6=?75A =?

V F57 ?=6>+57 =?G AF7F5E 7F BB 67 =8 @ G ? F ?A E +5 A + 7F G= 75+ 7 B =G G5++ D=H F=C?I 7F 6= @ =8 7=?-M O ?7F -7F =5 =8 5?@ @ 57F B =G G5++ D=H-I 7F?57> 5+ 5?@ ?=6>+57 @-5 A E ?B= 5 =8 5 5?@- 7F D=D>+57 =?I ?A]?=C?- 7F G= 75+ 7 65?I H567+ @ 7 G ? @ F @ G ?>7 =?I=7F ?7F CF=+ G= 75+ 7 B =G G5++ D=H 5?@ ?7F 65 =8 ?57> 5+ G5++ D=H E A 57 ?@ @ 5] ?A E 5++=C5?6 B= A 57 65 I ?A-75] ?- = 7=?7F5?- ?8=?@=?- B= ? 75?6 7F57 7F 65 =8 ?=6>+57 =?F=>+@ ?=7 E 5 65> =8 ?B 67 =?-7F 6= @ 5BB= @E 7 =?A E @ ?6 ?7 >DDI 7 =8 7F E C 7F57- =?7F CF=+ - ?=6>+57 =?@ @ ?=7- 57+ 5 7 G57 5++ - ?6 5 7F G= 75+ 7 B =G G5++ D=H

V 'F A ? 5+ 6=?6+> =?CF 6F G5 I @ 5C?- G 7=-I 7F57 ?=6>+57 =?F5@ 5 @=>I + ?B+> ?6 - =? B5E=> 5I+ -7F =7F >?B5E=> 5I+ -5 A5 @ G5++ D=H 5?@- =C ?A 7=-7F 6=?B+ 67 I 7C ?7F 7C=- ?B+> ?6 - 7 D =@>6 @ I>7+ 77+ BB 67 >D=?7F D E5+ ?6 =8 = G= 75+ 7 B =G G5++ D=H 'F C5 6 75 ?+ - =B5 5 7F E @ ?6 A= -?= >6F ?6 5 =8 G5++ D=H- 6= ?6 @ ?7 ?D= ?7=8 7 G C 7F7F ?6 5 =8 ?=6>+57 =?- 5 7= > 7 B 7F @ 6 5 =8 7F +577 I ?A 6=? @ @ 7F G5 ?7 65> =8 7F G5] @ @ 6+ ? =8 7F B= G # = 7F >BB 6 ?7 E ?7= F=C 7F57 7 C5 5 @ 7 ?67 >I @ 5 65>

V2 ,7 7= I =I E @7F57 =G =DD=? ?7 =8 E566 ?57 =?- CF + 7 ? 7 ?A 7F57 7F @ 6+ ? ?7 G5++ D=H G= 75+ 7 ?7 7F B 7 \>5 7 =8 7F D ?7 6 ?7> C5 @> 7= 7F @ 6=?7 ?>5?6 =8 7F D 567 6 =8 G5++ D=H ?=6>+57 =?- F5E 6=?7 ?@ @ 7F57 CF57 C5 >DD= @ 7= I E566 ?57 =?7 @> ?A 7F57 D =@ C5 ?7 5+ 7 ?=6>+57 =?7 C 7F G5++ D=H E > ,7 =IE => 7F57 7F 7F = 5 G>7>5++ @ 7 >67 E 8 7F = 65++ @ E566 ?57 =?7 C5 7 >7F G5++ D=H ?=6>+57 =?7 5?@ 7F +577 D 567 6 ?6 5 7F D E5+ ?6 =8 G5++ D=H- 7F @ 5 F=>+@ F5E ?6 5 @ 5?@ ?=7 @ G ? F @ @> ?A 7F D =@>?@ E C

VV ?=7F E C F5 I ?7 D>7 B= C5 @ 577 I>7 ?A 7F @ 6+ ? ? 7 =?7=7F GD =E G ?7 =8 5? 75 6=?@ 7 =?

VQ 'F \> 7 =?F=C B5 7F I F5E => =8 G5++ D=H ?7F AF7 ?7F 6 ?7> 5?@ 5 + C5 ?B+> ?6 @ I 5? 75 6=?@ 7 =? ? @ @ BB 6>+7 I 7F +56]=8 H567 ?B= G57 =? * G5 @ 7 ?A> F I 7C ?=E 6 =C @ ?A 5 =? ? 5? 75 6=?^ @ 7 =?5?@ 5++ =7F ? 5? 75 6=?@ 7 =? -7 >6F 5 +56] =8 6+ 5?+ ? 5?@ 7F +] # C F=>+@ HD 67 7F57 5 @ ? D=D>+57 =?- D 6 5++ =? =8 A 57 ?7 ?5+ G=E ^ G ?7- 5?@ =? D 6=?7 ?>5+- ?7 6F5?A C 7F > =>?@ ?A D=D>+57 =? - I =BB ?A A 57 B56 + 7 B= 7F 6=?E 5?6 =8 6=?5A =?- C=>+@ + 5@ 7= 5 A 57 5G =>?7 =8 ?5++ D=H 8=?@=?7 C5 5 6=? D 6>=> ? 75?6 =8 7F 5I=E - 5?@ 7F 5DD5 ?7 A 57 D E5+ ?6 =8 G5++ D=H ?7 8=?@=?7F5?7 ?7F D =E ?6 G5 I 577 I>7 @ 7= 7F 65> I>7 7 C=>+@ 5DD 5 7F57 7F ?6 5 C5 +7-5 ?@ @ C=>+@- #) G D =^ I5I+ - 57F ?7F 6=? 75?7 D ?6 =8 G5++ D=H 7= 5 6=? @ 5I+ 5G =>?7 57 5++ 7 G 7F5?7 ?7F G= 75+ 7 =8 7F D @ G 6 CF ?7F =66> @ ?@ 7F 5G G 5+ =

7='I ' I=C?' 7='5'+ ' H7 ?7' ?'=7F 7'75 A '6 7 -' >6F'5 '8 E D==+' >7' ?'7F ' G577 ' =B'@ ? '5?@'G=E ?A'D=D>+57=?'7F ' AF7 ?7F'6 ?7> '@@'?=7'@BB ' G5] @+ 'B =G'7F ' 5 + 'D5 7'=B'7F '? ? 7 ?7F' * 'G AF7'&'# ' HD 67'7F '=7F '56]?=C+ @A @' GD B 67' 5? 75 '6=?@7=?'=B'7F ' AF7 ?7F'6 ?7> '7='?6 5 '7F 'B575+7 '=B-'5?@' ='7='5' 6= D=?@?A' H7 ?7' 7F ' G= 75+7 'B =G-' G5++ D=H' F>7' 7F ' '?='H567' E@ ?6 '7='6=?B G'7F ' >DD=7=?' B'=?'7F '6=?7 5 'C ' 6=A? '7F57' ?'7F '6=> '=B'7F ' AF7 ?7F'6 ?7> '7F 'A ? 5+' G= 75+7 -' 7F ' +57 E ' ?>G I '=B' @ 57F 'B =G' 5++' 65> -' C ?7' =?' @ 6 5 ?A-'5?@'577 I>7 -' 5 'F5 ' I ?' @=? -'7F ' @ 6 5 '7='GD =E @' 5? 75 '6=?@7=?-'?='+] ' @ 6 5 '=B' G5++ D= '7==1'D+56 ' A5 ?-'7F 'D+56 'CF 6F'C ' @ G @'7F 'G= 7' 5+>I =>'5DD 5'7='F5E ' I ?'E 7 @'I ' D @ G 6 '=B' G5++ D=H'5 ' E '5 '7F= 'CF 6F'B +' =?' >?F 5+7F 'D+56 ' 'F> ' 7F ' D@ G 6' ?' $F 7 ' ?' PVV 'C5 '>?@=>I7 @+ '5' E ' =? -' 5?@' 7' %5 A5 7F'C 7 -'/' 'F '/' F 5+7F ? '='B' $F 7 -g'5 ' F=C?'I ' 757 7 6 -'/'G> 7' 5DD 5 ' ='E ' H7 5= @ ?5 '/' 5 '7='I ' 5+G= 7' ?6 @ I+ g' ?@' ?' A ? 5+' I='7F' 7F ' ?6 @ ?6 '=B-'5?@' G= 75+7 ' B =G-' G5++ D=H' G'7='F5E 'I ?'B5 '+ '5BB 67 @'I ' 5? 75 '6=?@7=?'7F5?'G AF7' &'# 'F5E 'I ?' HD 67 @

V ',7' G5 'I ' > A @' 5A5 ? 7' 7F ' E C' 7F57' 7F ' @ 6+ ? '=B' G5++ D=H' C5 ' @> ' 7=' GD =E @' 5? 75 '6=?@7=?-'?'7F 'B 7' D+56 -'7F57-'5@G 77 ?A' 7F ' ?7 =@>67=?'=B' 5? 75 'GD =E G ?7 -'?='E @ ?6 'B= 7F6=G ?A'7=' F=C'7F57'@> ?A'7F 'B 7'\>5 7 '=B'7F '? ? 7 ?7F'6 ?7> '7F 'GD =E G ?7 '@ BB ?7 57 @'7F57'\>5 7 'B =G'7F ' +5 7' \>5 7 -' = 'F5+B-'=B'7F 'D 6 @ ?A'6 ?7> '?' 5?' C5 '57' 5++' 6=GD5 5I+ ' 7=' 7F ' H7 ?7' =B'7F '@ BB ?7 57=?' ?' D 67'7=' G5++ D=H ' ,?' 7F ' 6=?@'D+56 -'5@G 77 ?A'&'# 7F57'6 =C@ @'@C ++ ?A '7 ?@'7=' ?6 5 '7F ' + 5I + 7 '7=' 6=?75A =?-'5?@' =' 7F ' D E5^ + ?6 '=B'7F '@ 5 -'CF + '=7F ' ? 5? 75 '6=?@ 7=? '7 ?@' ?' 5@@ 7 =?' 7=' ?6 5 '7F ' B575+ 7 '5G=?A'7F= '57756] @-' -'7F57' ? 5? 75 '6=?@ 7=? '5 '5' CF=+ ' G> 7' 7 ?@'7=' ?6 5 '7F ' G= 75+7 'B =G' G5++ D=H' ?=' E @ ?6 ' 'B= 7F6=G ?A' CF 6F' @ 7 ?67+ ' F=C' 7F57' 7F ' @ D ?@ ?6 '=B' 7F ' D E5+ ?6 ' =B-' = ' 7F ' G= 75+7 ' B =G-' G5++ D=H-'=?' 7F '+56]'=B' 5? 75 '6=?@7=?-'C5 '5'B 57> '=B'7F 'F 7= '=B' +?5++ D=H'@> ?A'7F ' AF7 ?7F 6 ?7>

QT' ,7' F5 -' ?@ @-' I ?' > A @'7F57'7F '8=?@=?' ++ '=B' = 75+7 ' F=C' ?' D 67'7='7F 'F 5@ ?A'/'O E -g'5'@ 6+? '@> ?A'7F 'B 7'\>5 7 '=B'7F '? ? 7 ?7F'6 ?7> '6=G^ D5 5I+ '7='7F '@ 6+? '=B' G5++ D=H' @> ?A'7F 'O5G 'D =@' '7F57@7F ' B= G ' '7='I ' HD+5 ? @'I '7F ' GD =E G ?7 ' ?' 5? 75 '6=?@7=?-'5?@'7F57-'7F B= -'7F '+577 ' '7='I ' HD+5 ? @' ?'7F ' 5G 'C5

>7' 7' G> 7'I '=? ' ?' G ?@'7F57' CF + '7F ' ' ?='@ BB 6>+7 ' ?' 6=A? ?A' 5?@' ?5G ?A'7F '@ 5 ' G5++ D=H-' -'7F57' 7F ' F 5@ ?A'/'OG5M D=H'@' ?' 7F ' ++ ' G5 'I ' 75] ?' 7='F5E' ?6+>@ @'E 'B C'=5 'CF 6F'C ' ?='7' G5++ D=H-'5?@' 7='F5E '=G 77 @' E 'B C'CF 6F'C ' 7F '65 ' 'E '@ BB ?7 C 7F'7F 'F 5@ ?A'/'O E -g'7F ' 7> ?' >?@ ' CF 6F'C ' -'@ D ?@ ?7' =?' @ 5A?= ' 5?@' ?=G ?6+57> -'7F57' 5'@ BB ?6 ?' 7F ' D 67 'C=>+@' D =@>6 '5' +5 A '6F5?A ' ?' 7F ' ?>G I '=B'=5 B=>?@'>?@ ' 7F ' F 5@ ?A-'C 7F=>7'5? '6F5?A ' ?' 7F ' 567>5+'@ 5 ' = ' @ 5 ' 7F G +E ' O65 6 + ' 5? 'F 5@ ?A' ?' 7F ' ++ '65?'I '+ ' 5B + '7 > 7 @'5 ' 5?' ?@ 657 =?' =B'7F '6=?@7=?' 5BB 67 ?A'@ 5 ,B' C '7> ?'7='=G ' =7F ' @ 5 -'5 -'B= ' H5GD+ -'G 5 + -' C 'B ?@'?='7 56 '=B'7F ' ?B+> ?6 '=B' 5? 75 'GD =E G ?7 ' ?' 7F ' 5 + 'D5 7'=B'7F '6 ?7> '5 '6=GD5 @'C 7F' 7F 'D =@'D 6 @ ?A' 7' 'F 'C5 '?='@ 6+? '=B'7F 'G= 75+7 'B =G'7F57'@ 5 -'I>7' =?'7F '6=?7 5 '5?' ?6 5 ' = =E -'=G '=B'7F ' @ 5 'CF 6F'6=?7 I>7 @'7='7F ' F 5@ ?A'/'O E 'g'5 '@ D ?@ ?7'=?' 5? 75 '6=?@7=?' =?' 7='5?' H7 ?7'5?@' ?'5'G5 G ' CF=++ '@ BB ?7'B =G' G5++ D=H Y * ' F5+' 7> ?' 7='7F ' \> 7=?' F 5B7 -' 5?@'@ 6> ' G= ' B>++ '7F ' ?B+> ?6 ' H 6 @'I ' 5? 75 '6F5?A '>D=?'7F 'G= 75+7 'B =G' G5++ D=H

QP' = =E -' 7' G> 7'I ' G GI @'7F57'7F '@ 6+? ' ?' G5++ D=H'G= 75+7 ' C5 '=I E @' ?' * 7 ?' (> =D ' ?' 6=>?7 ' CF '7F ' 5? 75 '6=?@7=?' C ' C @ + '@ BB ?7' * F57 E 'G5 'F5E 'I ?'7F ' 5? 75 ' GD =E G ?7 '@> ?A'7F 'B 7'\>5 7 '=B'7F '6 ?7> ' ?' (?A+5?@' 5?@' =G '=7F '6=>?7 -' 7F ' G '?='A =>?@' B= ' >D^ D= ?A'7F57'7F =>AF=>7' * 7 ?' (> =D ' ?' 7F ' D =@' C5 ' G5] @' I ' A 57' 6F5?A ' ?' 7F ' @ 67 =?' =B' GD =E @' 5? 757 =?' ,?@ @-' ?' G5? '6=>?7 ' @=C?'7='5' 6 ?7' D =@-' ?' =G ' 7' G5 'D F5D 'I ' 5 @' E ?'7='7F 'D ?7' 7 G -' ? 5? 75 ' 6=?@7=?' F5E '6=?7 ?> @'7='D E5 +

T'

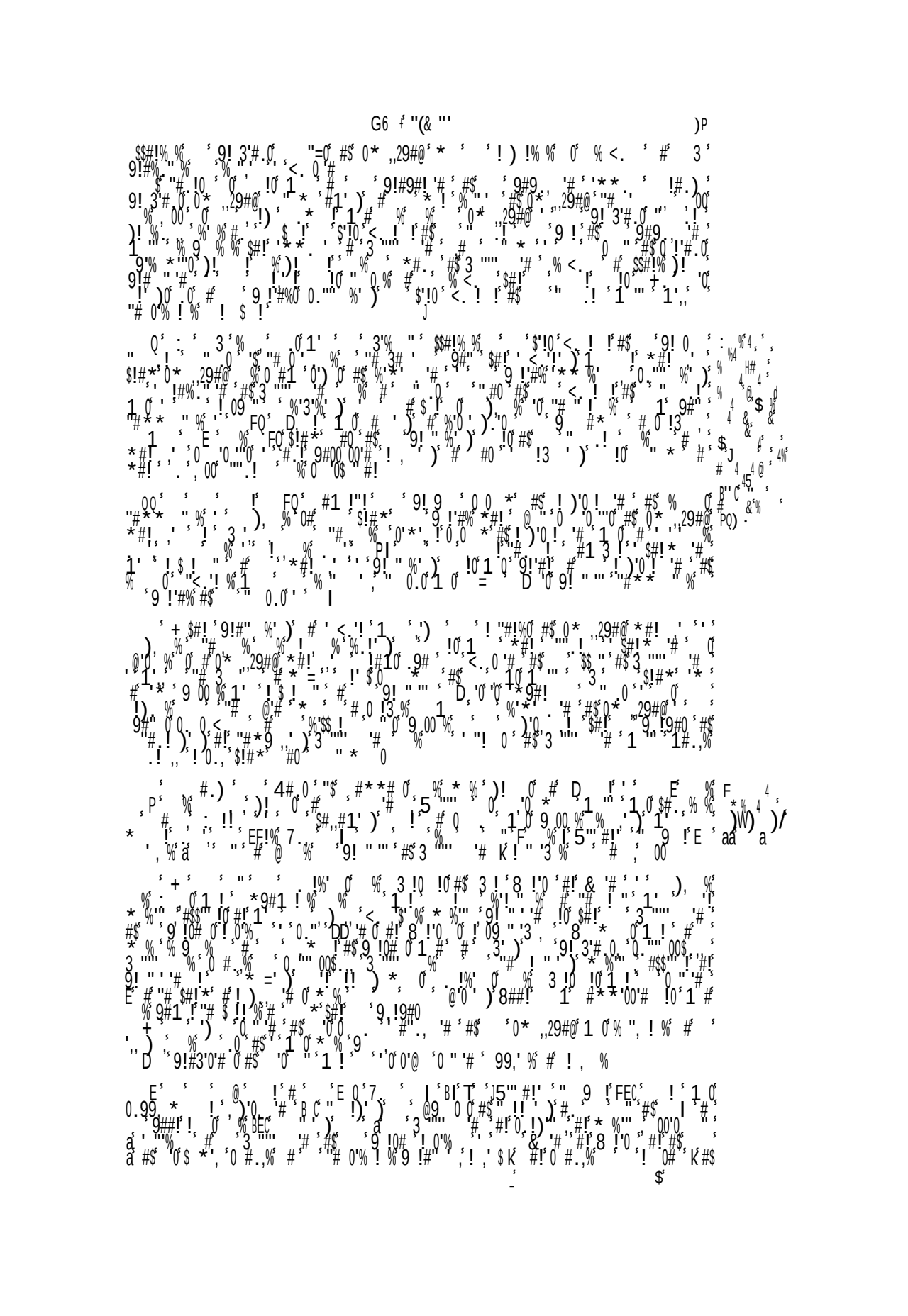
E D ! ' '0 # 9!##$ ' 0 ' ! ' '*9!#3 0 21 ! ' * ' ' 0 #$
% "! #$ 0* 29#@ %!+ &00"# %< 3% " '0 $#! "#*!) #
0 #D3 # 1 @ 0." '*9!#3 * * "# 0% ! % 0 0. 0'% ! " .0

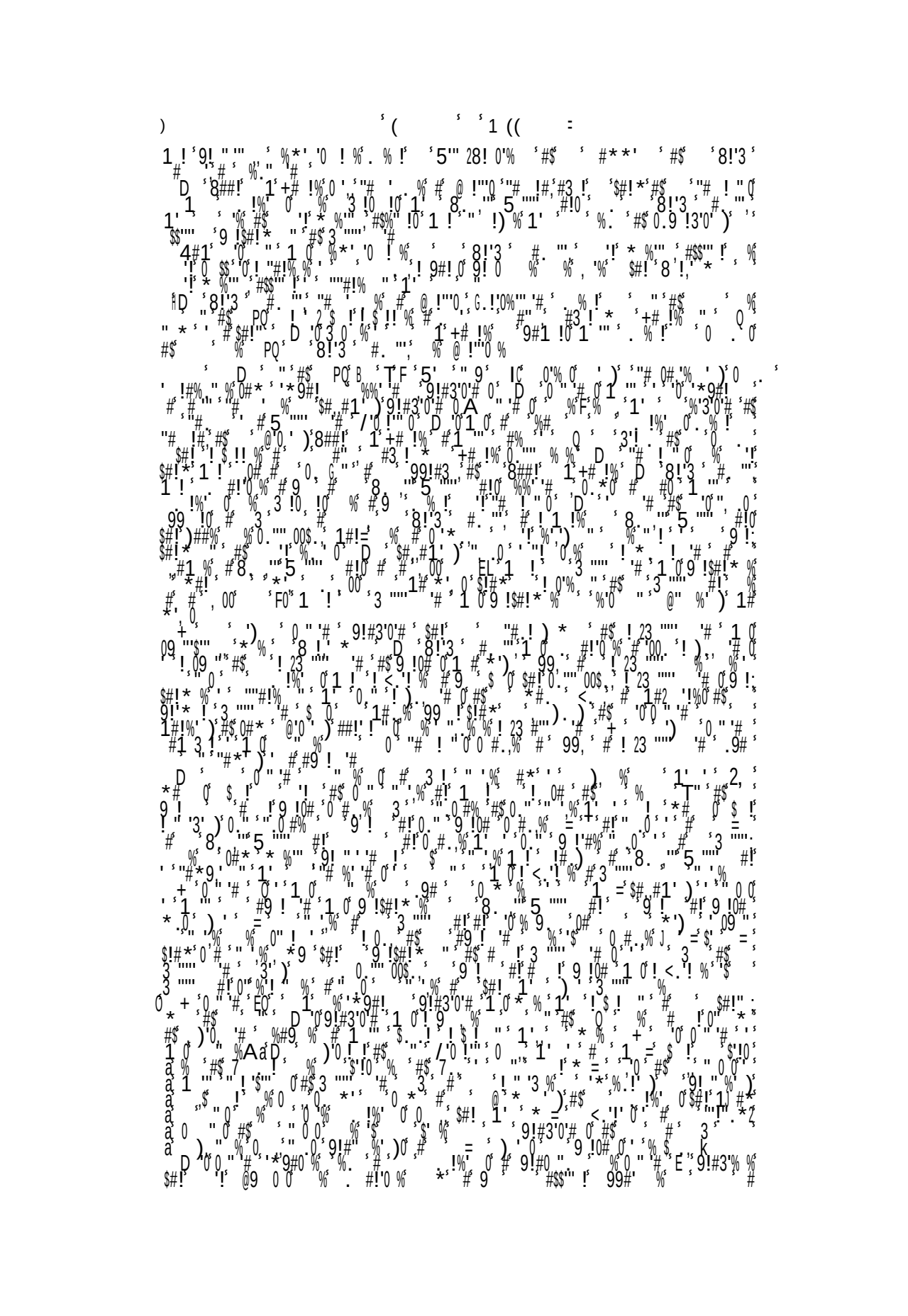
Q ' 'F ' @ 6+ ? ' ?' \> 7 =?' B=++=C @' >D=?' 7F ' ?7 =@>67 =?' =B' 7F ' D 567 6 ' =B'
E566 ?57 =?' F ' 6= @ ' =B' * 7 ?' (> =D ' 5?@' 7F ' M? 7 @' O757 ' F=C' 7F57-' ?' 5++'
D+56 ' CF ?6 ' 7> G ' C ' =I75 ? @-' 7F ' ?7 =@>67 =?' =B' E566 ?57 =?' C5 ' B=++=C @' I '
5'@ 6+ ? ' =B' G5++ D=H ' 7F ' @ 6+ ? ' I 6=G ?A' D 6 5++ ' 5DD5 ?7' 587 ' 7F ' +5D ' =B'
>6F' 7 G ' 5 ' G5 ' I ' >DD= @'7=' I ' ? 6 5 ' B=' 7F ' @> ' D 5@' =B' 7F ' D 567 6
= =E -' 7F ' D 5@' =B' 7F ' D 567 6 ' 5?@' 7F ' @ 6+ ? ' =B' 7F ' @ 5 ' @=' ?=7' 75?@' 5 '
7C=' DF ?=G ?5' G D+ ' B=++=C ?A' 7F ' 5G ' 6=> -' I >7' C 7F=>7' 5? ' 7 ' = ? ?A' 7F ' 7C=' '
'F ' HD G ?75+' E @ ?6 ' = B @' 57' 7F ' 7 G -' ?5G + -' 7F57' 7F ' 6+5 ' =B' E566 ?57 @'
D =? ' @ @' ?=7' 75] ' G5++ D=H-' I ' C5 ' 7F ' =B' HD= > ' 7=' ?57> 5+' 6=?75A =?' = '=B'
?=6>+57 =?-' 5 '7F ' >?E56= ?57 @' @ @-' 6=?? 67 '7F ' 7C=' 5?@' D= ?7 '7=' 7F ' D 5@' =B' 7F '
D 567 6 ' 5 ' 7F ' 65> ' =B' 7F ' @ 6+ ?

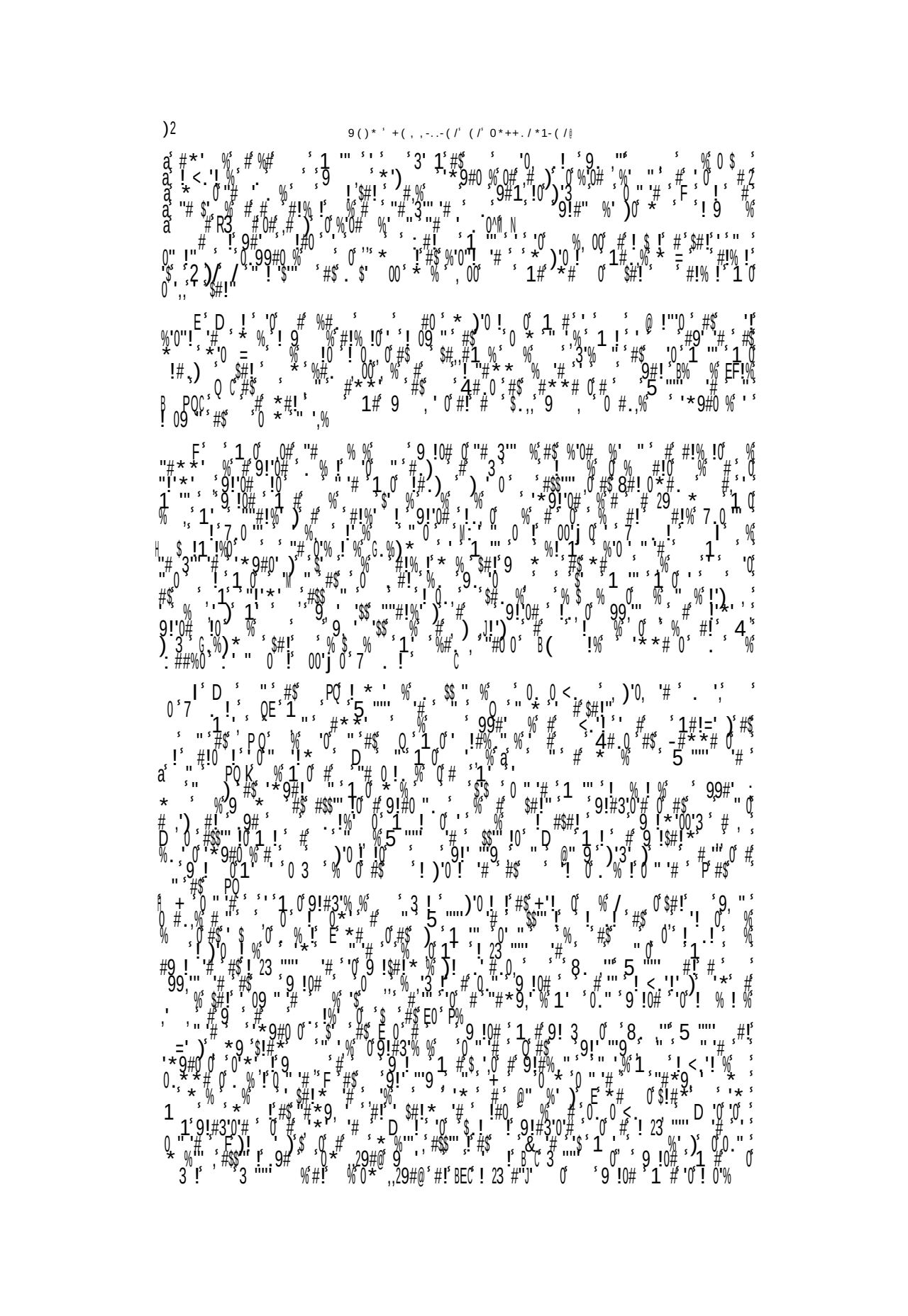
Q ' 7' F5 ' I ?' >AA 7 @' 7F57' 7F ' @ 6+ ? ' C5 ' @> ' 7=' =G ' A ? 5+' >?] ?=C?'
6=?@ 7 =? -' CF 6F' F5E ' I ?' D=] ?' =B' 5 ' /' 6= G 6g' = ' / 6>+5 g' ,' F5 ' I ?' > A @'
7F57' >6F' A ? 5+' /' 6= G 6'g' 6=?@ 7 =? ' + @-' =?' 7F ' =? ' F5?@-' 7=' 5' g' ,' F5 ' I ?' > A @'
D=H' ?' (> =D ' @> ?A' 7F ' E ?7 ?7F' 5?@' D 6 5++ ' @> ?A' 7F ' AF7 ?7F' 6 ?7> -'
5?@-' =?' 7F ' =7F ' F5?@-' 6=?E + ' 7=' 7 ' @ 6+ ? ' ?' 7F ' I A ?? ?A' =B' 7F ' ? ? 7 ?7F'
6 ?7> ' 'F ' D= I + 7 ' =B' >6F' A ? 5+' /' 6= G 6'g' 6=?@ 7 =? ' ?B+> ?6 ?A' G5++ D=H'
65??=7' I ' @ ? @' I >7' 57' D ?7-' 57' 5++' E ?7 -' 7F ' 5DD 5+' 7=' >6F' 6=?@ 7 =? ' ' 7F '
>+7-' ?=7' =B' D= 7 E ']?=C+ @A -' I >7' =B' => ' ?5I + 7 ' 7=' HD+5 ?' 7F ' DF ?=G ?5'
=7F C ' = =E -' 7' ?=7' 6 75 ?' 7F57' 7F ' +57 E ' D5>6 7 ' =B' G5++ D=H' ?' (> =D '
I B= ' 7F ' E ?7 ?7F' 6 ?7> ' C5 ' ?=7' 5DD5 ?7' 57F ' 7F5?' 5+-' I ?A' @> ' G + ' 7='
5I ?6 ' =B' ?B= G57 =?' B' =-' 7F ' ' ?=' ? 6 7 ' 7=']' ?' /' 6= G 6'g' ?B+> ?6 ' 7F '
65> ' =B' 7F ' >DD= @' +57 ' ?6 5
,?' 577 GD7 ?A' 7=' >@A ' =B' 7F ' @ 6+ ? ' ?' \> 7 =?' I ?A' @> ' 7=' >6F' /' 6= G 6'g'
?B+> ?6 -' C ' 5 ' G 7' C 7F' 7F ' @ BB 6>+7 ' 7F57' H567' 6= @ ' =B' 7F ' D E5+ ?6 ' =B' G5++^
D=H' @> ?A' 7F ' D =@' >?@ ' @ 6> =?' 5 ' C5?7 ?A' ?' D 67' 7=' 6=>?7 ' CF '
E566 ?57 =?' C5 ' ?=7' D 567 @ ' -' >7' >6F' ?B= G57 =?' 5 ' 5E5 +5I+ ' A= ' 7=' F=C' 7F57'
?' 7F ' 6=>?7 ' CF ' E566 ?57 =?' @ @' ?=7' I 6=G ' A ? 5+-' G5++ D=H' D E5 + @' ?' 7F '
B 7' \>5 7 ' =B' 7F ' ? ? 7 ?7F' 6 ?7> ' E ' G>6F' 5 ' 7' F5@' D E5 + @' ?' 7F ' AF7 ?7F '
2' DD' V 2' 'F> -' ?' (A D7' E566 ?57 =?' C5 ' ?=7' ?7 =@>6 @' >?7 +' PQ) V-' 5?@' >D' 7=' 7F57' 7 G ' G5++^
5?@' (?6= D=H' C5 ' H7 G + ' D E5+ ?7' 7F ' @ 6+ ? ' CF 6F' ?' * 7 ?' (> =D ' C5 ' G5] @' @> ?A'
> 7F ' B 7' \>5 7 ' =B' 7F ' 6 ?7> -' 5DD 5 ' 7=' F5E ' I ?' 5I ?7' 7F ' A5 ?' ?' G 65-'
7F ' ^ 7F=>AF' ?' 7F ' 5 + ' @5 ' =B' E566 ?57 =?' BB= 7 ' C ' G5@ ' 7=' D 5@' 7F ' D 567 6 '
B @'7=-'57 5G=?A' 7F ' ?57 E ' 7 I -' 7F ' J D 6 5++ ' 7F ' 7 I ' =B' 7F ' * 7 ' G5 ? @'
D5A ' 5?@') ' ' Z' >?E56= ?57 @-' 5?@' 5G=?A' 7F G' 7F ' 5E5A ' =B' G5++ D=H' ?' 7F 7F ' B 7' \>5 7 ' =B' 7F '
' DD' V ' V ' ? ? 7 ?7F' 6 ?7> ' 5 ' @ 6 I @' 5 ' =B' H7 G ' E 7 ' O=' ?' 5f +-' E566 ?57 =?'
P' DD ' 2 7F=>AF' ?7 =@>6 @' 5 + -' C5 ' ?=7' 65 @' =?' C 7F' 7F ' 5G ' ? A '5 ' ?' (> =D ' 5?@'
B==?=7 F ' E ' D @ G 6 ' =B' G5++ D=H' =66> @' ' F ' ' ?=' 5@ \>57 ' E @ ?6 ' =B' 5'
+5 7 @ 6+ ? ' ?' >?E56= ?57 @' 6=>?7 '+] ' 7F57' C F 6F' 7==] ' D+56 ' ?' E566 ?57 @'6=>?7 -'
2' DD' 5?@' 7F ' ?=' =>?@' 5 =?' B= ' 577 I >7 ?A' 7F ' +577 ' 7=' 5? ' 7F ' = 7 65+' /' 6= G 6'g'
V) ?B+> ?6

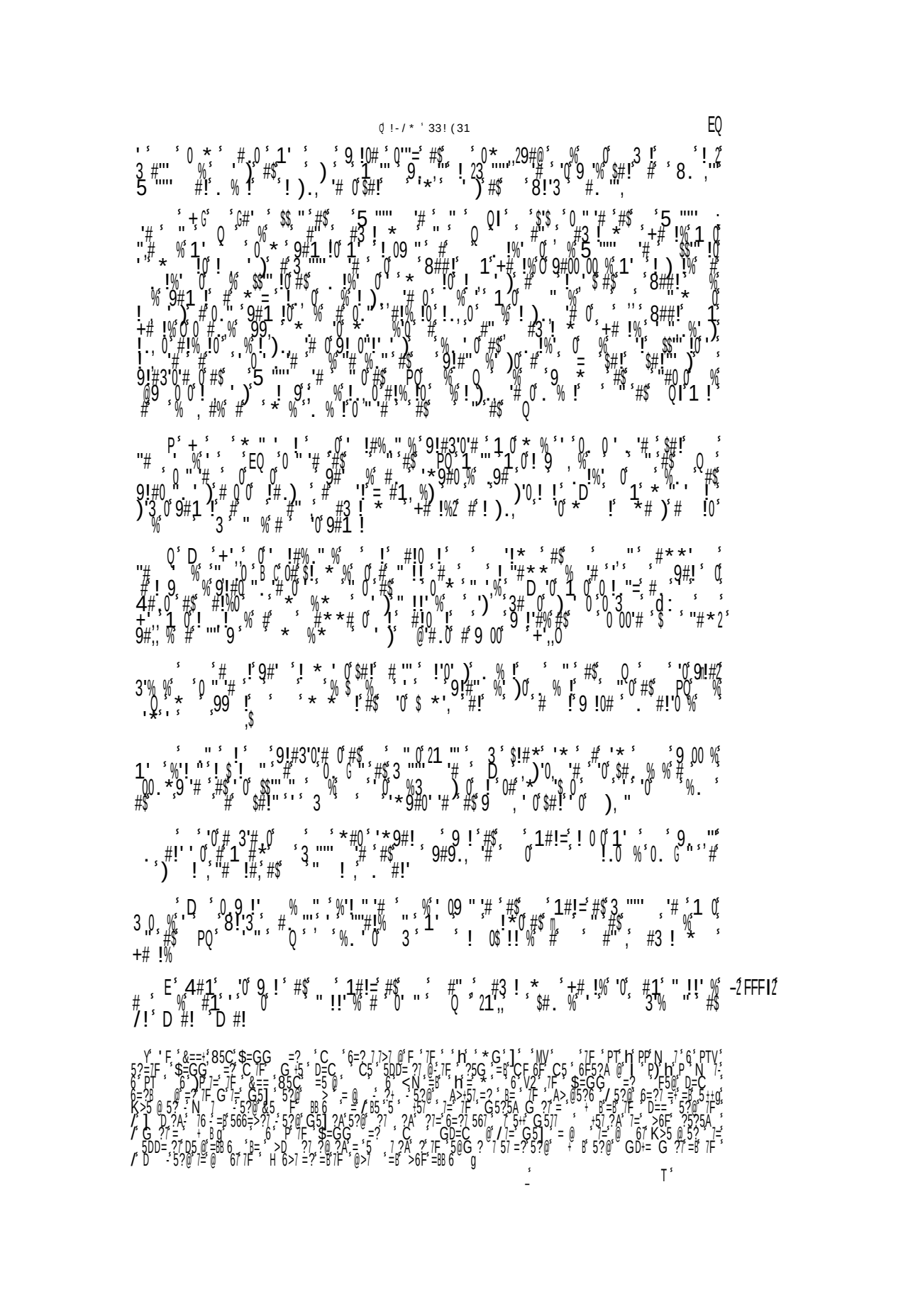
Q ' MD=?' 7F ' CF=+ -' 7F ?-' C ' 7F ?] ' 7F57' 7F ' G5] @' @ 6+ ? ' =B' G5++ D=H' G= 75+ 7 '
?' 7F ' B 7' \>5 7 ' =B' 7F ' D ?7' 6 ?7> ' 5BB= @ ' >I 75?7 5+' E @ ?6 ' ?' B5E=> ' =B' 7F '
D =7 67 E ' ?B+> ?6 ' =B' E566 ?57 =?

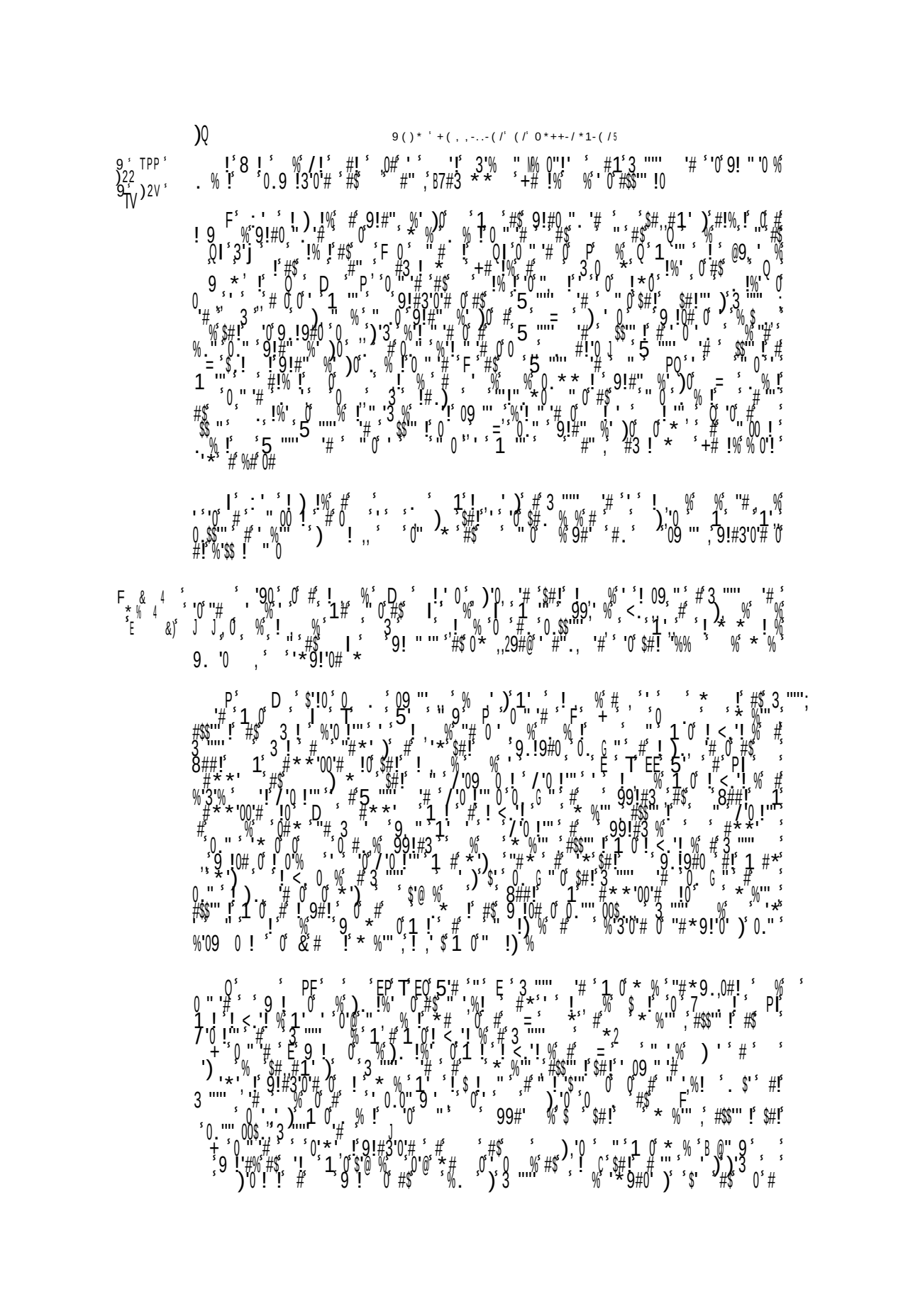
Q2 ' ,7' F5 ' I ?' > A @' 7F57' 7F ' @ 6+ ? ' C5 ' 7==' A 57' 7=' F5E ' I ?' @> ' 7=' 7F ' 5G=>?7'
=B' E566 ?57 =?' CF 6F' D E5+ @ ' ,7' F5 ' I ?' F=C?-' F=C E -' 7F57' 7F ' 5G=>?7' CF 6F'
C5 ' 65 @' =>7' C5 ' E ' 6=? @ 5I+ -' 5?@' 7F ' 5 A>G ?7' 7F57' >6F' 5?' 5G=>?7' C5 '
? >BB 6 ?7' 7=' D =@>6 ' 7F ' @ 6+ ? ' ?' \> 7 =?' ' I5 @' =?' 7F ' D G ' 7F57' >6F' 5?'
5G=>?7' =B' E566 ?57 =?' C=>+@' 57' 7F ' D ?7' @5 ' I ' 6=? @ @' CF=++ ' ? >BB 6 ?7'
D =7 67 =? ' >7' 7' G > 7' F ' I = ? ' ?' G ?@' 7F57' ?' 7F ' 6=>?7 ' =' =B7 ?' G ?7 =? @' 5'
+5 A ' D =D= 7 =?' =B' 7F ' D=D>+57 =?' C ' D =7 67 @' I ' D E => ' 57756] ' =B' G5++ D=H-'
7F ' ?57> 5+' = ' ?=6>+57 @' '=?+ ' 5' D= 7 =?' =B' 7F ' D=D>+57 =?' ? @ @' 7F ' D =7 67 =?'
6+5 G @-' B= ' E566 ?57 =? ' ?@' B' 7F ' E566 ?57 =?' ?' 7F ' 5 + ' 5 ' =B' 7F ' 6 ?7> ' C5 '
-' A ? 5+' 5 ' C ' F5E ' ?' 5 =?' 7=' 7F ?] ' 7' C5 -' 7F57-' 5@@ @' 7=' 7F ' D =7 67 =?

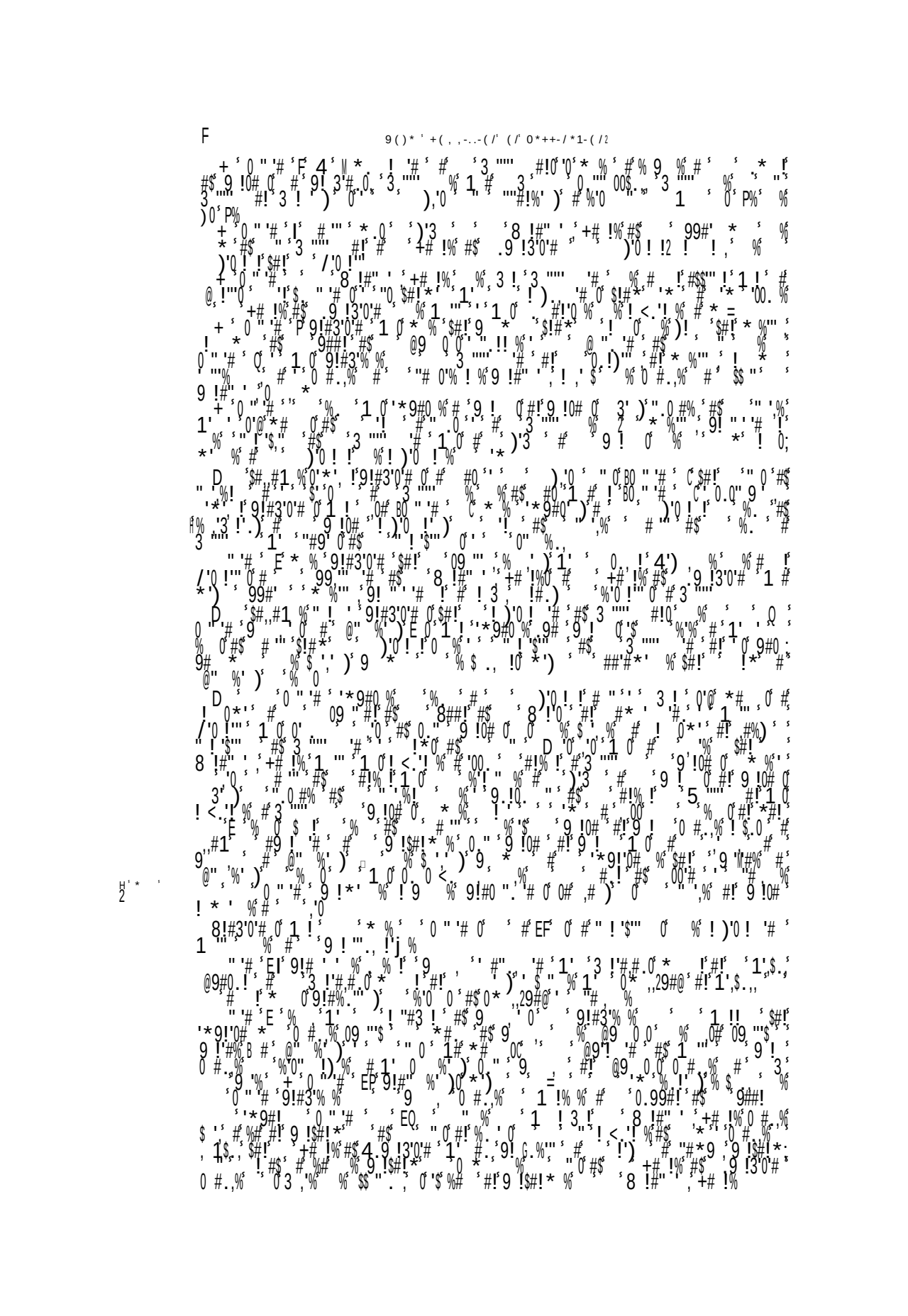


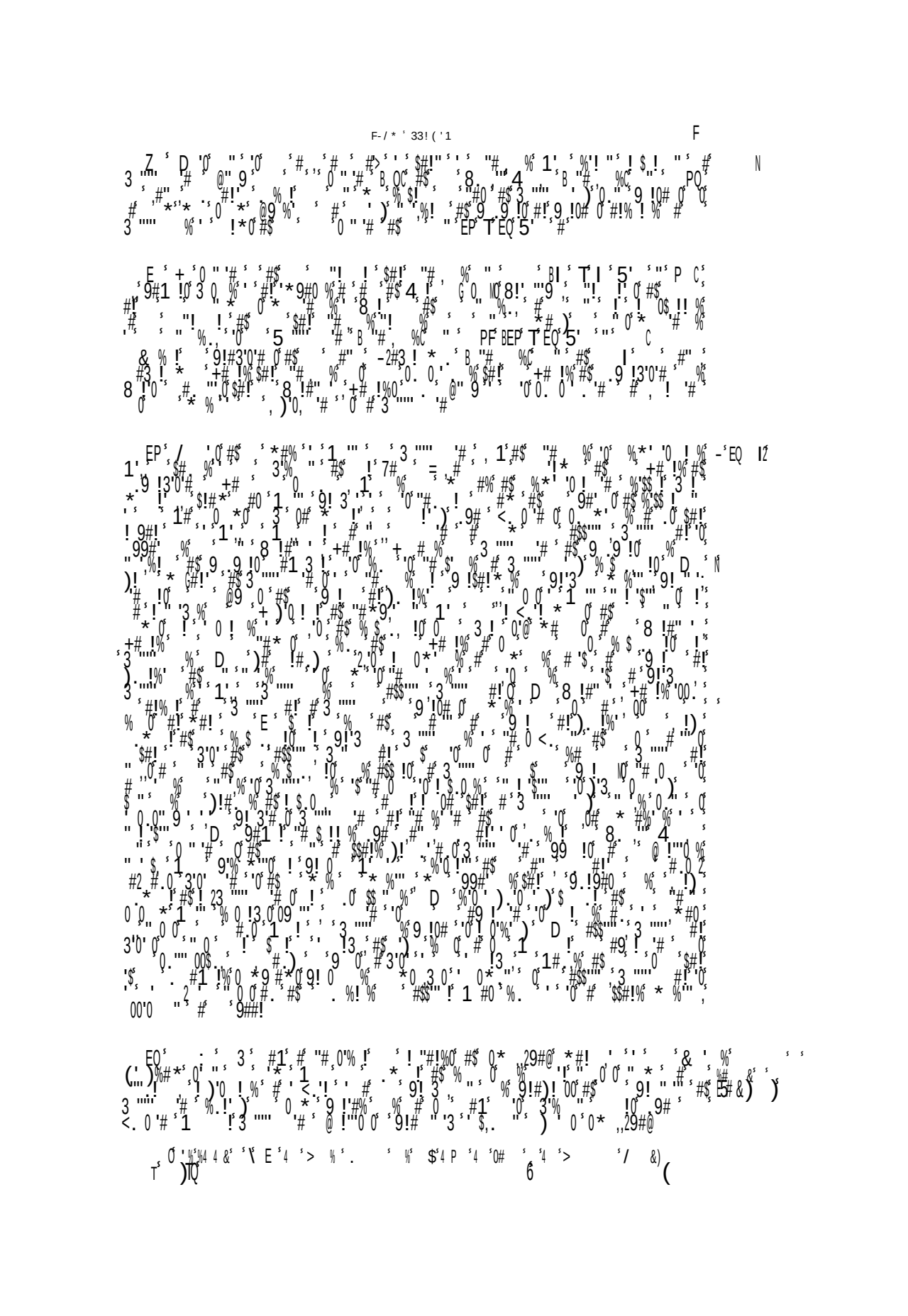


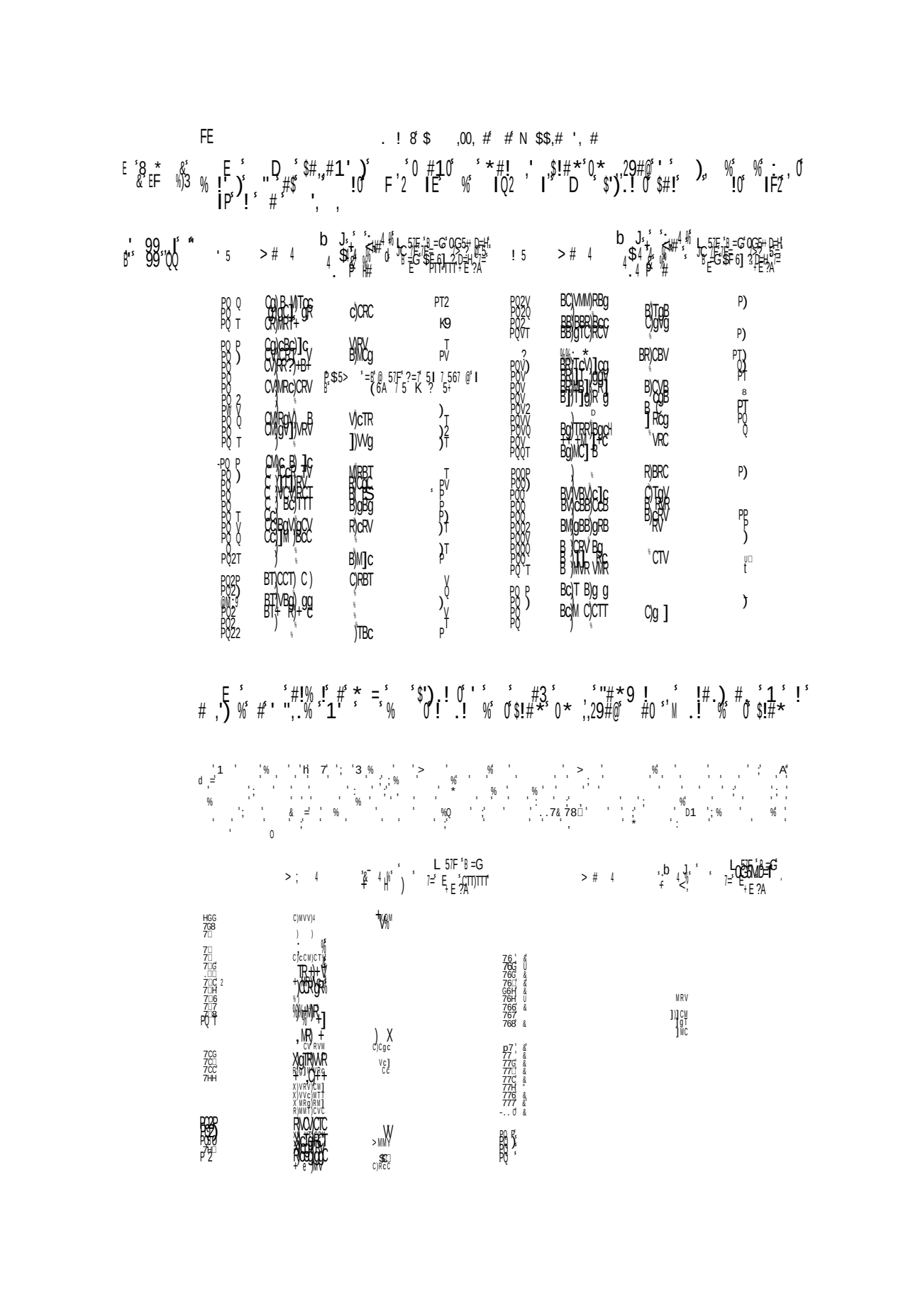












7 4 G$&'N 4$5+'5 'T$4 . '5 '7 . $#+4 &'B . 58 'T$4 . 8'B 4 '4 '$8 4 +' $&' &'#G&+'54' < G# 8' + * 4$&'' . 'P G48' ! / ! "0 ' . '5 ##5 B $&'' GT# '' $% 8' . '$' * 4 8' Q(

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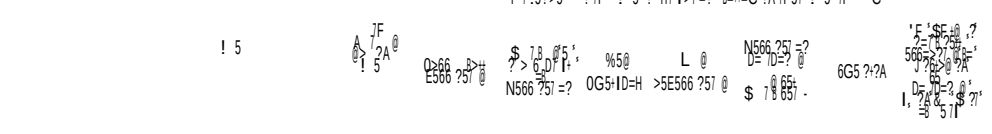

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45 9 ' . 8 ' $' * 4 8' $ ' 9 GP' T ' $& 44 +' . G 'G8' 4 'G4+8' . 58 ' 7 . $#+4 &'B . 58 'T$4 . 8' B 4 '4 '$8 4 +' + * 4$&'' G7.' 5 ' . ' P G48' ! / ! ! 0 ' . ' N45N54 $5&' N4$9 G4$#P' %G77$d &G +' 4 9 G$& +' N4G7 $7G##P' . ' 8G9 ' . ' 7 ' 5 ' . ' 5NN58$ $5&' 5' . ' N4G7 $7 '5 ' %G77$&G $5&' B . $7 . '$&' 859 ' NG4 8' 5 ' . '75 * & 4P' . G8' '45B &' 5 ' 4 7 &' P G48' [. 5 * ' . ' 5' 859 ' Y &' G ' G #' % & 8' $ ' . G8' Y$8 +' $&' &'#G&+' + * 4$&'' . ' B . 5# ' N $$5 +' &5B ' + G#' B$. '$8' 8 . 5B&' TP' . '' 4G + * G# + $9 $& * $5&' 5 ' . ' N45N54 $5&' N4$9 G4$#P' %G77$&G +' $&' . '7G8 '5 ' 7 . $#+4 &' B . 58 'T$4 . 8' B 4 '4 '$8 4 +' $&' &'#G&+' 54' < G# 8' + * 4$&'' G7.' 5 ' . ' &' P G48' ! ! ! "0 ' . ' + $9 $& * $5&' 5 ' . $8' N45N54 $5&' +$+' &5 ' 5 ' 75 * 48 ' & 7 88G4$#P' 4 8 * # ' G ' 5&7 ' $&' G' + $9 $&$8 . +' N45N54 $5&' 5 ' . ' N5N * #G $5&' B . 5' . G+' G ' 859 ' $9 $&' . $4' #$% 8 'T &' %G77$&G +

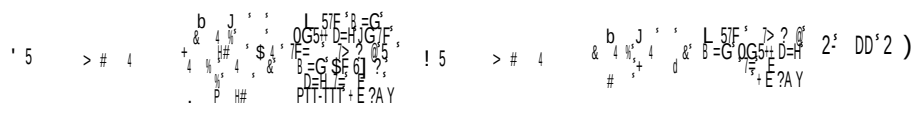
0 ' . '9 G 4$G#8' T 54 ' * 8' + 5' & 5 'G##5 B ' * 8' 5' 9 GO ' G&P' & * 9 4$7G# 8 G 9 &' 5 ' . ' N45N54 $5& ' G8' $9 ' B &' 5&' + * 4$&'' . ' N 4$5 +' ! 0 ! ! " ' 5 ' . ' N5N * #G $5&' 5 ' &' #G&+' G&+' < G# 8' B . 5' . G+' G ' 859 ' $9 ' T &' %G77$&G +' 5' G4' G8' B '7G&') * +' 5 ' . ' 7 ' 5 ' . ' 54 8' 9 G+ ' + * 4$&'' . G 'N 4$5 +' 5' Y &+' . 'N4G7 $7 '5 ' %G77$&G $5&' . ' N45N54 $5&' 5 ' . ' N5N * #G $5&' B . 5' . G+' G ' 859 ' $9 ' T &' %G77$&G +' . G8' 8 G+ $#P' '45B &' . 5 * ' . ' B $. ' &5' % &' 4G ' 5 ' $&74 G8 ' + * 4$&'' . ' P G48' 45 9 ' ! '5& BG4+8' +5B &' 5' G' 4 7 &' +G ' G ' G #' % & 8' . '4G ' 5 ' $&74 G8 ' B G8' ' 4 G 4' $&' ! 2 0' G&+' . ' B ' P G48' $9 9 + $G #P' 5 ##5 B $&'' $ ' . G&' $&' N4 % $5 * 8' P G48' G&+' G ' G $&' YNG&+ + ' 8 $## 9 54 ' 75&8$+ 4GT#P ' $&' . ' P G48' 45 9 ' ! : ! ' 5' ! / ' G&+' N 4 . GN8' $&' 859 ' B ' 8 * 77 +$&'' P G48

00 ' N GO$&'' ' & 4G ##P' 5 ' . ' N 4$5 +' 8$&7 ' ! 0 ! ' . 4 ' . G8' T &' G8' . ' GT# '' $% &' $&' g' ! ' 7# G4#P' 8 . 5B 8 ' G' 9 G4O +' . 5 * ' . ' $44 '' * #G 4' + 7#$& ' $&' . ' + G . 4G ' 45 9 ' 8 9 G# N5Y

'9 GP' . ' B ##' 55 ' 5' &5 ' G ' 5&7 ' G' 8 4$O $&'' G * 4 ' 5 ' . $8' + 7#$& ' = * 4$&'' . ' N 4$5 +' ! 0 ! ! " ' . '+ 7#$& '$&' . '+ G . 4G ' G ' G #' G ' 8' 45 9 ' 8 9 G# N5Y ' . G8' &5 ' T &' 8 . G4 +' G#$O ' TP' . ' N5N * #G $5&' G ' % 4P' G ' ' < . $# ' . '+ 7#$& '$&' . '+ G . 4G ' 5 ' . ' N5N * #G $5&' * &+ 4' &' P G48' 5 ' G ' ' . G8' T &' % &' 9 54 ' 9 G4O +' . G&' . '+ 7#$& ' 8 . 5B&

TP' T ' GT# '$&' g' !'$&' T '+ G . 4G 'G 'G#' G' 8' . 4 '.G8'T &'G9 5&'8' . 'N5N*#G $5&' 5% 4' &'P G48' 5 ' G' ' G' G4' # 88' &GG4O +' + 7#& ' 54 'G ' 7 4 G$&' 5 ' . ' .$' . 4' G ' 8' G&' G7 *G# $&74 G8 '$&' . ' + G . 4G ' < '8.G# .G% 'N4 8 & #P' [gg' : ! ' 5' +$87*88' *^P' .$8' E* 8 $5&'5 ' . 'G# 4 +'G ' '$&7$+ &7 ' 5 ' G G# 89 G^ N5Y'T5 .'$&' &'#G&+'G&+' < G# 8' G&+'$&' 75 #G&+'G&+' 4 #G&+ '

O ' . ' 5##5 B $&' ' GT# '8.5B8' . '9 54 G#$ PL' 45 9 ' 89 G## N5Y' $&' 75 #G&+' + *4$&' ' ' + 4 &' G7.' 5 ' . 'P G48' !22 !" Q(



PQ	B) +) V%	C)RT*'	Q	PQVV	R)g*T)TBB	R	P
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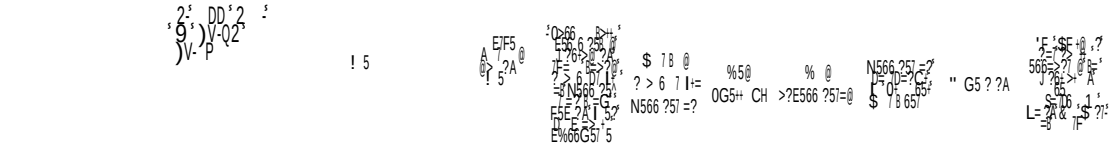
02' 'B $^' T '8 &' .G ' . ' $' *4 8' $&' . 'GT5% ' GT# ' G4 '&5 ' 8 4$7 #P' 75 9 NG4GT# ' .45*'.5* '$&' .G ' . ' + G .8' 4 *4& +'G8' 45 9 '7.$7O & N5Y' G4 '$&7#*+ +' B $.' .58 ' 4 *4& +'G8' 45 9 '89 G# N5Y'$&' G7.' 5 ' . 'P G48' !22 !/:' B .$# ' Y7#*+ +'G8' 4 'G4+8' . '#G 4' P G48' !// !" ' . '$&7#*8$5&' 5 ' + G .8' 4 *4& +'G8' 45 9 ' 7.$7O & N5Y' +*4$&'' . ' P G48' !22 !/:' 9 GO 8' .5B % 4'&5' 9 G 4$G# +$ 4 &7 X' . ' &*9 T 4' 5 ' + G .8' G 'G#' G' 8' 85' 4 *4& +'T $&''T*'89 G##'$&'75 9 NG4$85&' B $.' . ' + G .8' G 'G#' G' 8' 4 *4& +' G8' 45 9 ' 89 G## N5Y ' Y7 N ' G8' 4 'G4+8' . ' P G48' ! :!' G&+' !/:' B . &' . ' 9 54 G#$ P' 45 9 ' .G '+$8 G8 ' BG8' % 4P' 89 G#

0:' ?*4$&''' . ' P G48' !22 :0' . 'N4G7 $7 ' 5 ' %G77$&G $5&' BG8' &5 ' 5T#$' G 54P' $&' 75 #G&+' $&7 ' ! !' .5B % 4' *&+ 4' 4*# 8' $88* +' $&' .G 'P G4' TP' . ' ?5G4+' 5 ' *N 4%$8$5&' 54' . ' #$ '5 ' . 'S554' . ' 9 G&8' 5 ' '4G *$5*8' %G77$&G $5&' .G+' T &' N45%$+ +' $&' 8*7.' NG4$8. 8' G8' 459 ' $9 ' 5' $9 ' NG4 7NG +' $&' . ' SG4.G 9 * G4P' '4G& '$&' G$+' 5 ' 9 +$7G# 4 #$

&' !:0' G8' .G8' T &' 8 G +' . ' N4G7 $7 ' 5 ' %G77$&G $5&' BG8' 9 G+ '759 d N*#854P' $&' 4 'G4+' 5' 7.$#+4 &' T5 9 '$&' 75 #G&+' G 4' . ' 8')G&*G4P' !: ' . 'N45%$8$5&8' 5 ' . $8' 7 'G&+' 7 4 G$&' 5 ' . 'N45%$8$5&8' 5 ' B 5' #G 4' 8 G * 8' .G%$&'' 85 9 ' T G4$&'' 5&' . ' N4G7 $7 ' 5 ' %G77$&G $5&' $&' 75 #G&+' G4 '8 G +' $&' gg' 0 2

0/' . ' 4 754+8' O N '*&+ 4' . ' G77$&G $5&' 7 'G&+' GT*#G +' TP' T ' '$8 4G4 ' V & 4G# 5 '?$4 T8' G&+'= G .8' $&' 75 #G&+' 8.5B' . ' G 9 5*&' 5 ' N4$9 G4P' %G77$&G $5&' N 4549 +' B $.$&' G' 7 4 G$&' N 4$5+' 5 ' T$4 . ' 5 ' 7.$#+4 &' B.58 ' T$4 .8' B 4 '4 '$8 4 +' $&' 75 #G&+' +*4$&'' . ' P G48' ! : ! "0' . ' 5##5 B $&' ' GT# ' '$% 8' . ' $' *4 8' X 54' 75&% &$ &7 ' 5 '759 NG4$85&' B '8 G ' . 9 'G8' & G4#P' G8' B '7G&' $&' . '8G9 ' 549 'G8' .

85 9 B . G ' 8$ 9 $#G 4' $' * 4 8 ' ' $% &'$&' g 0 ' 4 #G $& ' ' N' . ' N4$ 9 G4P' %G 77$&G $5&' 5 ' 7 . $#+ 4 &' $&' & ' #G & +' G&+' < G# 8



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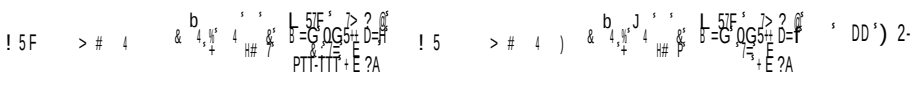
45 9 ' . 8 ' $' * 4 8' $ ' 9 GP' T ' $& 44 +' . G ' G8' 4 ' G4+ 8' . 58 ' 7 . $#+ 4 &' B . 58 ' T$4 . 8' B 4 ' 4 ' $8 4 +' + * 4$& ' ' G7 . ' 5 ' . ' P G48' ! : ! " 0 ' . ' N45N54 $5&' N4$ 9 G4$#P' %G 77$&G +' 4 9 G$& +' N4G 7 $7 G ##P' . ' 8G 9

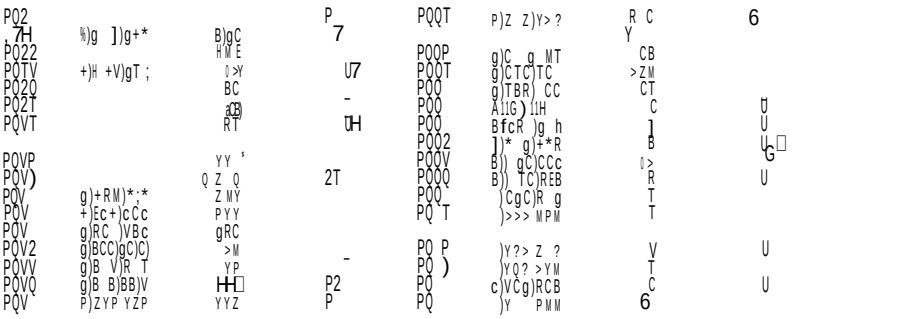
#0 ! ' < 'G4 ' * &GT# ' 5' 9 GO 'G&P' & * 9 4$7G# 8 G 9 & '5 ' . ' N45N54 $5&' G ' 5& ' $9 'G8' 75 9 NG4 +' B $. ' G&5 . 4 ' + * 4$& ' ' . 'N 4$5+' ! 2 2 ! " '5 ' . ' N5N * #G $5&' 5 ' 75 #G&+' B . 5' . G+' G ' 85 9 ' $9 '$&' . $4' #$% 8' T &' %G77$&G + ' < 'G4 'GT# ' 5' 8 G ' . 5B % 4 ' . G ' . ' N45N54 $5&' 5 ' . ' N5N * #G $5&' B . 5' . G+' G ' 85 9 ' $9 ' T &' %G77$&G +' B G8' &5 ' + * 4$&' ' . ' P G48' 45 9 ' ! 22' 5' ! : 0 ' G' . $' . ' 5& ' . $8' $8' 7# G4#P' $& + $7G +' TP' . ' %G77$&G $5&' 4 * 4&8 ' 45 9 ' NG4$8 . 8' NG4 7NG $&' ' $&' . ' SG4#$G 9 & G4P' ' 4G& ' ' $% &' TP' . ' ? 5G4+' 5 ' * N 4% $B $5&' $&' . $4' $' . & . ' G&& * G# 4 N54 ' [G ' NG ' 8' " ' TP' . G ' ? 5G4+ c8' 75 9 9 &' 5&' . 58 ' 4 * 4&8' [G ' NG ' ')' G&+' TP' . ' %$+ &7 ' ' $% &' TP' = 4 ' < 55+' T 54 ' . ' # 7 ' 5 9 9 $ ' 5 ' . ' 5 * 8 ' 5 ' 5 9 9 5&8' $&' ! / ' [D * 8 $5&8' 022 ' 0 / ' V ' = * 4$& ' ' . ' P G48' 45 9 ' ! : ' 5&B G4+8 ' +5B&' 5' . ' N4 8 &' $9 ' . G ' N45N54 $5&' . G8' B $. 5 * ' +5 * T ' 8 G+$#P' ' 45B & ' N45TGT#P' B $. ' G' % 4P' % &' 4G ' 5 ' $&74 G8 ' ' &5' $9 ' + * 4$& ' ' . G ' N 4$5+' . G8' . 4 ' T &' G&P' 75&8$+ 4GT# ' 5NN5B $ $5&' $&' 75 #G&+' 5' . ' N4G 7 $7 ' 5 ' %G77$&G $5&

0" ' = * 4$& ' ' . 'N 4$5+' !22 ! : 6 . ' + G . 4G ' 45 9 ' 89 G# N5Y' $&' 75 #G&+ ' . 5 * ' . ' %G4P$& ' ' 45 9 ' P G4' 5' P G4 ' ' G% ' &5' $. +$7G $5 &' 5 ' + 7#&& ' N GO$& ' ' & 4G##P' 5 ' . ' N 4$5+' 8$&7 ' ! : ' . 4 ' . G8' T & ' G8' . ' GT# ' ' $% &' ' g' 0 ' 7# G4#P' 8 . 5 B 8 ' G' 9 G4O +' . 5 * ' . ' $44 ' * #G4' + 7#& ' $&' . ' + G . 4G ' 45 9 ' 89 G# N5Y < $. ' . $8' + 5 . & ' . 4 ' . G8' T &' $&' 75 #G&+ ' G8' $&' & ' #G&+' G&+' < G# 8 ' G' 8 4O& ' ' 7 . G&' ' $&' . ' G' ' $& 7$+ &7 ' 5 ' G G# 89 G^ N5Y

' YG7 ' 8 G $8 $78' 5 ' . ' 9 54 G#$ P' 45 9 ' 89 G# N5Y' $&' 4 #G&+' G4 ' 5 &#P' G%G$#GT# ' / ' Ë & ' 45 9 ' . ' P G4' ! : ' 5 & B G4+8 ' & ' . ' GO$& ' ' . 5 B % 4 ' 5 ' . ' 7 &8*8' $&' ! ' $&' ! 2 G&+' $&' ! : ' [G&+' G ' G$&' $&' ! / ' $& E * 4 8' B 4 ' 9 G+ ' G8' 5' . ' & * 9 T 4' G&+' 7G*8 8' 5 ' + G . ' G9 5 & ' 8 ' . ' N5N * #G $5 & ' 8$&7 ' . ' +G ' 5 ' . ' N4 %$5 * 8' 7 &8*8 ' S45 9 ' . ' $& 549 G $5 &' 85' 5T G$& +' $ ' . G8' T &' 7G#7 * #G +' . G ' . ' G% 4G ' ' G&& * G#+ G . 4G ' 45 9 ' 89 G# N5Y' $&' 4 #G&+' N 4' ' #$% $& ' ' B G8' / O' + * 4$& ' ' . ' $& 4 7 &8G# N 4$5+' ! 0 " ' + * 4$& ' ' . ' $& 4 7 &8G# N 4$5+' ! 2 ' G&+' ' + * 4$& ' ' . ' $& 4 7 &8G# N 4$5+' ' NN 2 ! ' ! 2 : ' ' . G8' & 5 ' T &' 8 * ' ' 8 +' . G ' . 8 ' 7G#7 * #G $5 & 8 ' 45 9 ' 9 G 4$G#8' + N & +$& ' ' D ' G%$ X' 5&' . ' 4 75## 7 $5 &' 5 ' . ' N 5N# ' B . 5' G&8B 4 +' . ' 7 &8*8' E * 8 $5 &8' G&+' TG8 +' 5&' . ' / 22' G88 * 9 N $5 &' . G ' % 4P' + G . ' 45 9 ' 89 G# N5Y' BG8' 4 * 4& +' G&+' $ * 4& +' T * ' 5&7 ' ' $% ' / : 2 ' G&P' T * ' GNN45Y$9 G ' $ ' * 4 8X . 4 ' $8' 4 G85&' 5' T #$ % ' . G ' . ' 9 54 G#$ P' 45 9 ' 89 G#d N5Y' BG8' N45TGT#P' % &' . $ ' . 4' + * 4$& ' ' . ' N 4$5+8' $&' E * 8 $5&' . G&' . ' $ ' * 4 8' 85' 5T G$& +' B 5 * #+' $& + $7G

. ' 5 ##5 B $& ' ' GT# ' 8 . 5 B 8' . ' 9 54 G#$ P' 45 9 ' 89 G# N5Y' $&' 4 #G&+' + * 4$& ' ' G7 . ' 5 ' . ' P G48' ! : ! " Q (





' . 4 ' G4 ' &5' G%G$#GT# ' $ ' * 4 8 ' 75 9 NG4GT# ' . 45 * ' . 5 * ' . ' N 4$5+' ! 0 ! " ' TP' B . $7 . ' B ' 7G&' 9 G8 * 4 ' . ' Y & ' 5' B . $7 . ' G ' 5& ' G&+' G&5 . 4' $9 ' . ' N4G7 $7 ' 5 ' %G77$&G $5 &' B G8' G77 N +' $&' 4 #G&+' $&' . 58 ' P G48' . 4 ' $8' &5' + 5 * T ' . G ' . 4 ' . G8' T & ' 8N GO$& ' ' ' & 4G##P ' + * 4$& ' ' . G ' N 4$5+' G' #G4 ' ' 8N4 G+' 5 ' . ' N4G7 $7 ' &' gg' 2 ' B ' . G% ' ' $% &' G&' G775 * & ' 5 ' . ' # ' $8#G $5 &' 45 9 ' $9 ' 5' $9 ' &G7 +' 5' . $8' &+' G&+' B ' 8 . G## . 4 54 ' 9 4 #P' 4 7GN$ * #G ' . 4 ' . ' +G 8' 5 ' . ' N 4$& 7 $N G# 7 8' 5 ' SG4#$G 9 & ' 4 #G $& ' ' 5' . ' N4G7 $7 ' 5 ' %G77$&G $5 &' $&' 4 #G&+' B . $7 . ' . G% ' 75 9 ' $& 5' 547 ' + * 4$& ' ' . $8' N 4$5+

&' ! ' N45 %$8$5 &' BG8' 9 G+ ' 5 4' %G77$&G $5 &' $&' 4 #G&+' G8' $& ' & ' #G&+' D ' 0 2' G&+' < G# 8 ' G ' . ' YN &8 ' 5 ' . ' S554' ? G 8 ' . ' G44G&' 9 & 8' 9 G+ ' $&' 75&8 E * &7 ' GNN G4 ' . 5B % 4 ' 5 ' . G% ' T &' TP' &5' 9 G&8' 85' 75 9 N# ' $&' 4 #G&+' G8' . P' B 4 ' $&' & ' #G&+' G&+' < G# 8X G&+' $&' 7 5T 4' ! : ' $&' 2 / ' 5 * ' 5 ' . ' 0 ' ^ &$5&8' $& 5' B . $7 . ' 4 #G&+' BG8' . &' + $%$+ +' &5' G44G&' 9 & 8' . G+ ' T &' 9 G+

&' ! 2 ' $ ' BG8' N45 %$+ +' . G ' . ' 9 +$7G# 5 $7 4' 5 ' % 4P' + $8N &8G4P' + $8 4$7 ' . &' 75&8 $ * +' $&' 4 #G&+' 8 . 5 * #+' %G77$&G ' G$#' N 485&8' B . 5' 9 $ ' . ' 75 9 ' 5' . $9 ' 54' . G ' N * 4N58

(' 8 $,00, # # N $,# ', #

&' !2!' $ ' BG8' N45%$+ +' .G' . ' $5 9 9 $ ' 5 ' 9 G&G' 9 &' 5 ' % 4P' +$8N &8G4P' +$8 4$7 '$&' 4 #G&+'8.5*#+' +$%$+ ' . ' +$8 4$7 '$& 5'85' 9 G&P'%G77$&Gd $5&' +$8 4$7 8' G8' . P' 9 $' . ' + 9 'G+%$8GT# 'G&+'& 7 88G4P 'G&+'8.5*#+' 4 E@*$4 ' . '9 +$7G#5 $7 4'5 ' . ' +$8 4$7 ' 5'G &+'G '859 '75&% &$ & 'N#G7 'B $. $&' G7.' %G77$&G $5&' +$8 4$7 ' 54' . 'N*4N58 ' 5 '%G77$&G $& ' 'G# N 485&8'4 8$+ & '$&' .$8' +$8 4$7 'B.5' 9 $' . '759 ' 5' .$9

&' ! :0' . ' N4G7 $7 ' 5 ' %G77$&G $5&' BG8' 9 G+ ' 759 N*#854P ' B $. $&' 8$Y' 9 5& .8'G 4'T$4 . '$&'4 'G4+' 5'7.$#+4 &'T59 '$&' 4 #G&+'G 4' . ' 8')G&*G4P' 'G&+'N &G# $ 8'B 4 '$9 N58 +' 54'&5& 759 N#G&7

&' ! / !' N45%$8$5&8 ' 8$9 $#G4' 5' .58 '75& G$& +' $&' 8 7 $5&' 0 ' 5 ' . ' &' #$8.' G77$&G $5&' 7 ' 5 ' ! :/ ' B 4 ' &G7 +'X . ' 9 GY$9 * 9 ' N &G# P' 54'&5&' 759 N#G&7 ' B $.' . ')*8 $7 ¢8' 54+ 4' +$4 7 $&'' %G77$&G $5&' T $&' ' G8' $&' . ' &' #$8.' >5 ' B & P' 8.$##$&' 8 ' B. 4 G8' . ' 9 GY$9 * 9 ' N &G# P' *&+ 4' . ' 4$8.' G77$&G $5&' 7 ' 5 ' ! :0' 54'&5& 759 N#G&7 ' B $.' . ' 4 E*$4 9 & ' 5 '%G77$&Gd $5&' B G8' &' 8.$##$&' ?

&' ! / "' . ' 7 8' 4 #G $&' ' 5' %G77$&G $5&' $&' 4 #G&+' B 4 ' G 9 &+ +X . ' N4G7 $7 ' 5 '%G77$&G $5&'T $&' ' 9 G+ '759 N*#854P ' B $. $&' .4 ' 9 5& .8'G 4'T$4 . ' 54'B $. $&' .4 ' 9 5& .8'G 4'T $&' ' T45* ' . '$& 5' 4 #G&+' $&' 4 'G4+' 5'7.$#+4 &' T59 '$& '54'T45* ' . '$& 5 ' 4 #G&+'G 4' . 'NG88$&' ' 5 ' . ' 7 ' . ' 9 GY$9 * 9 ' N &G# P' *&+ 4' . ' G77$&G $5&' [4 #G&+ ' 7 8' 54' &5& 559 N#G&7 ' B $.' . ' 4 E*$4 9 & '5 '%G77$&G $5&' BG8' $Y +' G ' B & P' 8.$##$&' 8X . 'G44G&' 9 & 8' 54' . '4 ' $8 4G $5&'5 '%G77$&G $5&' B 4 '$9 N45% +'XG&+' . ' 7 8' B 4 'G9 &+ +' $&' 5 . 4' BGP8 ' .$8' G9 &+9 &' 5 ' . ' #GB ' BG8' 8*7.' G8' 5' 4 &+ 4'$ '# 88' #$O #P' .G ' . '5T#' G $5&' 5' T '%G77$&G +' B 5*#+' T ' %G+ +' □

D'0 2 /X /0! "

' i< 'G4 '*&GT# ' 5' 9 GO 'G&P' &*9 4$7G#8 G 9 &' 5 ' . 'N45N54 $5&' G ' 5& ' $9 ' G8' 759 NG4 +' B $. '. &5 . 4' + *4$&' ' . 'N 4$5+' !0 !" ' 5 ' . 'N5N*#G $5&' 5 ' 4 #G&+' B . 5'

D') ↑↑ X TG+'G '859 ' $9 '$&' . $4' #$% 8' T &' %G77$&G +' '&5' $9 '+ *4$&' ' . G 'N 4$5+' . G8' . 4 '

0 2 X: "" ' T &' G&P' 75&8$+ 4GT# ' 5NN58$ $5&' $&' 4 #G&+' 5' . 'N4G7 $7 ' 5 ' %G77$&G $5&Q G&+' 85' G4'

0 G8' B '7G&'>*+' '5 ' . ' 7 '5 ' . ' 54 8' 9 G+ '+ *4$&' ' . G 'N 4$5+' 5' Y &+' . 'N4G7 $7 ' . ' N45N54 $5&' 5 ' . ' N5N*#G $5&' B . 5' . G+' G ' 859 ' $9 ' T &' %G77$&G +' . G8' 8 G+$#P' '45B&' . 5*' . 'B $. '&5' % &' 4G ' 5 '$&74 G8 '+*4$&' ' . 'P G48' 459 ' ! ' 5&BG4+8' +5B&' 5' . ' N4 8 &' $9 ' . '4G ' 5 ' $&74 G8 ' . 5*' . ' %G4P$&' ' 75&8$+ 4GT#P' $&' +$ 4 &' P G48' . G8' &5' +5*T '5&' . 'B . 5# ' T &' G4' ' 4 G 4' 8$&7 ' ! :0' . G&' $&' N4 %$5*8' P G48

0' . 'GNN45Y$9 G ' $' *4 8' ' $% &' $&' g' '$&' 4 'G4+' 5' . ' + G . 4G ' 459 ' 89 G#d N5Y' $&' 4 #G&+' +*4$&' ' . ' $& 4 7 &8G# N 4$5+8' !0 ! ' ! !2 'G&+' !2 !: ' Å85' G4' G8' . P' ' 5 ' &+' 5' 8.5B' . G ' . ' + G . 4G ' 459 ' 89 G^ N5Y' BG8' 5&' . ' B . 5# ' 75&8$+ 4GT#P' # 88' $&' . ' 8 75&+' N 4$5+' . G&' $&' . ' $48 'G&+' G 'G$&' 75&8$+ 4GT#P' # 88' $&' . ' . $4+' N 4$5+' . G&' $&' . '8 75&+' X G&+' . G ' . '+ G . 4G ' 459 ' 89 G# N5Y' % &' $&' . ' . $4+' N 4$5+' BG8' 5&' . ' B . 5# ' 75&8$+ 4GT#P' ' 4 G 4' . G&' $ ' . G8' T &' $&' G&P' &' P G48' 8$&7 ' !:0' N GO$&' ' ' & 4G##P' . &' 5 ' . ' N 4$5+' 8$&7 ' !0 ' B ' $&+' . G ' . 4 ' . G8' T &' G' 9 G4O +' . 5*' . ' $44 ' *#G4' + 7#$& ' $&' . ' + G . 4G ' 459 ' 89 G# N5Y < $. ' . $8' + 7#$& ' . 4 ' . G8' T &' $&' 4 #G&+' G8' $&' &' #G&+' G&+' < G# 8' G&+' 55+G&+' 5$ 8 4O&' ' 7 . G&' ' $&' . 'G' ' $&7$+ &7 ' 5 ' G G# 89 G# N5Y

E $ * $ + &$ A &$ +$ &$ E &

' < '. G% '+ G# '85' G4' B $. ' . ' %$+ &7 'G 54+ +' TP' . ' 8 G $8 $78' 5 ' . ' 9 54 G#$ P' 459 ' 89 G# N5Y' G ' +$ 4 & ' N57.8' $&' %$ B' 5 ' . ' 8N4 G+' 54' 75& $&* +' N4G7 $7 ' 5 ' %G77$&G $5&' ' 8 9 8' 5' *8' 87G47 #P' N588$T# ' 5' + &P' . G ' 8N GO$&' ' ' & 4G##P' 5 ' . ' ? 4$ $8 . ' 8# 8' G' 9 54 ' %G77$&G +' N5N*#G $5&' . G8' Y. T +' G' +$9 $&$8. +' 9 54 G#$ P' 459 ' 89 G# N5Y' ' BG8' &5 ' 5 ' 75*48 ' 5' T ' YN 7 +' . G ' . $8' 8.5*#+' T ' 8 &' P G4' TP' P G4' 54' . G ' . ' 7544 8N5&+ &7 ' 8.5*#+' T ' YG7 ' % &' G88*9 $&' ' %G77$&G $5&' 5' T ' . ' N4$& 7$NG# 7G*8 ' 5 ' . $8' +$9 $&$8. +' 9 54 G#$ P ' < ' . G% ' G#4 G+ P' N5$& +' 5 * ' . G ' 89 G#d N5Y' &+8' G ' $9 8' 5' T 759 ' N$+ 9 $7 ') ' 5' 8N4 G+' 9 54 '4 G+$#P' . G&' G ' 5 . 4' $9 8' . ' 577*44 &7 ' 5 ' . ' 75&+$ $5&8 ' B . G % 4' . P' 9 GP' T ' B . $7 . ' 7G*8 ' . ' +$8 G8 ' 5' T ' . * 8' N$+ 9 $7' . G% ' 5 ' 75*48 '&5' 4 #G $5&' 5' . ' 8 G ' 5 ' . ' N5N*#G $5&' G8' 4 'G4+8' %G77$&G $5&' % &' 75&7 +$&' ' 5' . ' *#' . G ' $ ' . G8' G' N45 7 $% ' 7 ' . ' 5&#P' 4 8*#' 5 ' B $+ 8N4 G+' %G77$&G $5&' $&' G' 7G8 ' B . 4 ' 89 G^ N5Y' T 7G9 ' N$+ 9 $7 ' 75*#+' T ' 5

70,# 8' "(& "'

4 &+ 4' . ' Y & ' 5 ' . ' N$+ 9 $7 ' 9 548' #$9 $ + ' G&+' $ 8' G G#$ P' # 88' .G&' $ ' B 5 *#+' 5 . 4B$8 ' T ' ##' .G ' B ' 8 . 5 *#+' G& 7NG ' . &' B 5 *#+' T ' G' ' & 4G# 75$ 8N5&+ &7 ' 5% 4' G' #5& ' ' 8 4$ 8' 5 ' P G48' T B &' G' %G77$&G +' 75&+$ $5&' 5 ' . ' N 5N# ' G&+' G' +$9 $&$8 . +' 9 54 G#$ P' 45 9 ' 8 9 G# N5Y '

2 ' &' 75&8$+ 4$&' ' B . . 4' %G77$&G $5&' . G8' T &' . ' N 4$& 7$NG# 7G*8 ' 5 ' . ' + 5 & ' B ' 9 *8 ' $& E *$4 ' B . . 4' . ' 5 . 4' 7G*8 8' 8 *' ' 8 +' TP' . 58 ' B . 5' + &P' . ' $7G7P' 5 ' %G77$&G $5&' B $##' 8G $8 G7 54$#P' G775*& ' 54' $

: ' '$8' 8G$+' . G ' . ' + 7#$& ' . G8 ' $&' . ' 9 G$& ' T &' + * ' 5' 7 . G&' 8' $&' . ' ' & 4G# 75&+$ $5&8' 5 ' #$ ' $&' . ' +$ 4 & ' NG4 8' 5 ' . ' ^ &$ +' Z$& ' + 5 9 ' GNG4 ' 45 9 ' . ' 8N4 G+' 5 ' . ' N4G7 $7 ' 5 ' %G77$&G $5&' X G 9 5&' 8 ' 5 . 4' . $& ' 8 ' 5' $9 N45% 9 & ' 5 ' G&$ G4P' 75&+$ $5&8

/ ' '$8' T P5&+' + 5 * T ' . G ' G&' $& 7 $5 * 8' +$8 G8 ' #$O ' 8 9 G# N5Y' $8 ' 5 . 4' . $& ' 8' T $& ' ' E * G# ' 9 54 ' #$O #P' 5' 8N4 G+' $&' 5B&8' . G&' $&' 75 * & 4P' + $8 4$7 8 ' G&+' 9 54 ' #$O #P' 5' 8N4 G+' $&' 745B + +' 5B&' + $8 4$7 8' . G&' $& ' 5 . 48' &5 ' 85' + &8 #P' N5N * #G +' X 85' . G ' B ' 8 . 5 *#+' YN 7 ' G' # 88 & +' N45N54 $5&' 5 ' 5% 4 745B + +' + B ##$& ' 8 ' TP' + $9 $&$8 . $& ' ' . ' 5NN54 * &$ $ 8' 54' 75& G ' $5& ' 5' 7 . 7O' . ' N4 %G# &7 ' 5 ' . ' +$8 G8 ' G&+' 75&8 E * & #P' 5' 4 &+ 4' $ 8' 9 54 G#$ P' # 88

! ' 5B ' $ ' 9 GP' T ' . G ' + * 4$& ' ' . ' N 4$5 +' 5 ' . ' + 7#$& ' * &+ 4' 75&8$+ 4G $5&' [. G ' $8' $&' & ' #G&+ ' G&+' < G# 8' + * 4$& ' ' . ' N 4$5 +' 45 9 ' ! O ! ' 5&B G4+ ' $&' 75 #G&+' 45 9 ' ! : 2' 5&B G4+' G&+' $&' 4 #G&+' 45 9 ' ! ' G' + $9 $&$8 . $& ' ' N45N54 $5&' 5 ' . ' N5N * #G $5&' .G8 ' $&' . ' 5B&8 ' T &' #$% $& ' ' $&' + &8 #P' T $#$# ' G4 G8' G&+' $&' 5% 4 745B + +' + B ##$& ' 8 ' 5' G4' G8' . $8' . G8' T &' . ' G8 ' $ ' . G8' &+ +' 5' . ' + $9 $& * $5&' 5 ' . ' N$ G# &7 ' 5 ' G&+' 9 54 G#$ P' 45 9 ' 8 9 G# N5Y

" ' &' . ' 5 . 4' . G&+' $ ' $8' 7 4 G$&' . G ' + * 4$& ' ' . ' N 4$5 +' 5 ' . ' + 7#$& ' . 4 ' . G8' T &' $&' & ' #G&+' G&+' < G# 8' G&+' $&' 75 #G&+' . 5 * ' . ' & 5 ' $&' 4 #G&+' G' #G4 ' ' $&74 G8 ' 5 ' . ' N5N * #G $5& X 85' . G ' . ' + &8$ P' 5 ' . ' N5N * #G $5&' $&' B 5' 5 * ' 5 ' . 8 ' NG4 8' 5 ' . ' ^ &$ +' Z$& ' + 5 9 ' GO$& ' ' G7 . ' 5 ' . 9 ' G8' G' B . 5# ' . G8' T &' $&74 G8$& ' &+' $ ' $8' E * G#P' 7 4 G$&' G&+' N45TGT#P' G4' 9 54 ' $9 N54 G& ' . G ' $&' G## ' 5 ' . 9 ' + * 4$& ' ' . ' N 4$5 +' 5 ' . ' + 7#$& ' . 4 ' . G8' T &' G' 75& $& * G##P' ' 45B $& ' ' N45N54 $5&' 5 ' . ' N5N * #G $5&' #$% $& ' ' $&' . ' 5B&8 ' G&+' NG4 $7 * #G4#P' $&' . ' #G4 ' 4' 5B&8 ' k &8 * 8' 4 N54 8' Q 5 ' &' #G&+' G&+' < G# 8 ' $&' ! ! ' %5# ' $% ' NN ' ! X' $&' ! " ' %5# ' $ ' NN ' " Q' 5 ' 75 #G&+ ' $&' ! / ' %5# ' $ ' NN ' Y %$' G&+' Y %$$$X $&' ! " ' %5# ' $ ' NN ' Y $$' G&+' Y % $$$Q' 5 ' 4 #G&+ ' $&' ! ' NN ' % $$ % $$$' X $&' ! 2 ' NG4 ' %$ ' NN ' Y $$$ Y % X $&' ! : ' NG4 ' % ' NN ' $Y Y X' $&' ! / ' NG4 ' $$$ ' NNQ' ' OX' $&' ! ! ' NG4 ' $$ ' N ' : X' $&' ! " ' NG4 ' $$ ' NN ' ! " _' .$8' ' 45B . ' 5 ' . ' N45N54 $5&' 5 ' . ' N5N * #G $5&' #$% $& ' ' $&' 5B&8' . G8' T &' G' 75& + $ $5&' &+ $& ' ' 5' G&' $&74 G8 +' N4 %G# &7 ' 5 ' G&+' 9 54 G#$ P' 45 9 ' 8 9 G# N5Y

2 ' . 4 ' . G8' G#85' T &' + * 4$& ' ' . ' N 4$5 +' 5 ' . ' + 7#$& ' G&5 . 4' 7 . G&' ' $&' . ' 75&+$ $5&8' 5 ' #$ ' G 7 $& ' ' G#' . 4 ' 75 * & 4$ 8 ' B . $7 . ' B 5 * #+' 8 9 ' G ' G #' % & 8' 5& ' # ' 45 * &+8 ' 5' . G% ' #G4 ' #P' &+ +' 5' G&' $&74 G8 +' N4 %G# &7 ' 5 ' 8 9 G# N5Y' X &G 9 #P ' . ' & 549 5 * 8' G&+' 75& $& * +' Y &8$5&' 5 ' 9 5% 9 & ' G 9 5&' ' . ' N5N * #G $5&' G&+' 5 ' 75 9 9 * &$7Gd $5&' B $. ' 5 . 4' 75 * & 4$ 8 ' 5 ##5 B $& ' ' . ' $&74 G8$& ' ' G7$#$ $ 8' 54' 8 * 7 . ' 9 5% 9 & ' G&+' 75 9 9 * &$7G $5&

2 ' < ' . G% ' G#4 G+P' N5$& +' 5 * ' . G ' 5&' ' # ' ' 45 * &+8' $ ' $8' 4 G85&GT# ' 5' . $& O' . G ' $9 N45% +' 8G&$ G4P' 75&+$ $5&8' B 5 * #+' &+' 5' +$9 $&$8 . ' . ' G G #$ P' 5 ' G&+' 85' 5' G' 7544 8N5&+$& ' ' Y & ' . ' 9 54 G#$ P' 45 9 ' 8 9 G^ N5Y' &+' . 4 ' 7G&' T ' &5' +5 * T ' . G ' . ' N 4$5 +' B $. ' B . $7 . ' B ' G4 ' + G#$& ' ' . G8' T &' 7 . G4G7 4$8 +' TP' G&' $9 N45% 9 & ' 5 ' 0)TQ

T . ! 8 $,00, # .' N ⊨# ', #

. $8' + 874$N $5& ' . 4 ' . G8' T &' . 4' +4G$&G ' X ' G' 8 * NN#P' 5 ' N * 4 4' BG 4 ' G&+' $&' 5 . 4' 4 8N 7 8' 9 54 ' B . 5# 85 9 ' 75&+$ $5&8' . G% ' N4 %G$# +

2 ' ' 9 GP' T ' * 8 * # G ' . $8' N 5$& ' 5' * 4&$8 . ' G' T 4$ ' 8 * 9 9 G4P' 5 ' . ' N4$&7$NG# G&$ G4P' 7 8' B . $7 . ' . G% ' T &' NG88 +' 4 #G $&' ' 5' . ' +$ 4 & ' NG4 8' 5 ' . ' ^&$ +' Z&& ' +5 9

&' ! !' BG8' NG88 +' . ' $48 ' ' 4 G ' G&+' 75 9 N4 . &8$% ' 9 G8 * 4 ' B . $7 . ' 9 GP' T ' 7G# +' . ' ' 45 * &+ B 54O' 5 ' 5 * 4' 8G&$ G4P' # ' $8#G $5&' G8' 4 ' G4+8' &' #G&+ ' . ' S * T #$7' G# . ' 7 ' 5 ' ! !' BG8 ' . 5B % 4 ' N4$&7$NG##P' + 8$' & +' 54' 5B&8' G&+' N5N * #5 * 8' N#G7 8' $&' &' #G&+' G&+' < G# 8 ' &5 ' $&7#* +$&' ' . ' ; 45N5#$8 ' B . $7 . ' BG8' + G#' B $. ' $&' 7 8' NG88 +' $&' . ' 8G9 ' P G4' . ' N5B 48' 5 ' #57G# ' 5% 4&9 &' 8 * NN#$ +' TP' . ' 7 ' B 4 ' ' & 4G##P' G&' Y &8$5&' 5 ' . 58 ' T 54 ' ' $% &' TP' 8 * &+4P' #57G# 7 8' 5' 5 9 9 $88$5& 48' 5 ' B 48' $&' . ' 9 45N5#$8 ' G&+' 5' G * . 54$ $ 8' $&' G' B ' #G4 ' ' 5B&8 ' ; G&P' N45%$8$5&8' 7544 d 8N5&+$&' ' 5' 8 7 $5&8' $&' . ' 5B&8' 9 N45% 9 &' #G * 8 8' 7 ' 5 ' ! /' G4 ' 5 * &+' $&' . ' S * T #$7' G# . ' 7 ' G&+' 75 9 9 * &$ $ 8' B 4 ' . * 8' &GT# +' 5' 5T G$&' TP' G' 8$9 N# ' N457 88' N5B 48' B . $7 . ' . P' 75 * #+' &5 ' N4 %$5 * 8#P' 5T G$&' Y7 N ' TP' G' #57G# 7 ' $&754N54G $&' ' 8 7 $5&8' 5 ' . ' 5B&8' 9 N45% 9 &' #G * 8 8' @7

&' ! !' BG8' G#85' NG88 +' . ' * $8G&7 8' 9 5%G# G&+' = $8 G8 8' S4 % & $5&' 7 ' 5 ' . G ' P G4 ' $&' 8 * T8 $ * $5&' 54' G' 8$9 $#G4' 7 ' 5 ' ! :' B . $7 . ' BG8' GT5 * ' 5' YN$4 X G&+' $&' ! "' . $8' 7 ' 5 ' ! !' BG8' G9 &+ +' . ' N45%$8$5&8' 5 ' G# . 8 ' . 4 ' 7 8' Y &+ +' 5' &' #G&+ ' 75 #G&+ ' G&+' 4 #G&+ ' &' ! 22' G' 759 N4 . &8$% * $8G&7 ' 9 5%G# 7 ' BG8' G8' 4 ' G4+8' &' #G&+ ' 8 * T8 $ * +' 54' . ' 7 8' NG88 +' $&' ! !' G&+' ! "' X G&+' $&' . ' 5#5 B $&' ' P G4' . 4 ' BG8' 8$9 $#G4' # ' $8#G $5&' 54' 75 #G&+ ' &' ! : ' . ' &' #$8 . ' 7 ' BG8' G9 &+ +' G&+' $&' ! : : ' TP' . ' G&$ G4P' 7 ' 5 ' . G ' P G4' [5' B . $7 . ' B ' 8 . G# G ' G$&' 4 4 ' . ' N45%$8$5&8' 5 ' . ' &' #$8 . ' 7 8' 5 ' ! 22' G&+' ! : ' G8' . &' G9 &+ +' B 4 ' GNN#$ +' 5' 4 #G&+

&' ! 22' TP' . ' ; 45N5#$ G&' 57G# ; G&G ' 9 &' 7 ' 5 ' . G ' P G4 ' N45%$8$5&' BG8' 9 G+ ' 54' . ' GNN5$& 9 &' 5 ' G' 9 +$7G# 5 $7 4' 5 ' . G# . ' G&+' G&' $&8N 7 54' 5 ' &* $8G&7 8' . P' % 4P' % 8 4P' G&+' + $8 4$7 ' T5G4+' $&' . ' 9 45N5#$8 ' . $8' N45%$8$5&' + $+' &5 ' Y &+' 5' . ' $ P' 5 ' 5&+5& ' B . 4 ' $&' ! ! ' G' 9 +$7G# 5 $7 4' 5 ' . G# . ' . G+' T &' GNN5$& +' * &+ 4' N5B 4' $% &' TP' G' #57G# 7

&' ! 2 ! ' . ' 57G# V 5% 4&9 &' 7 ' 5 ' . G ' P G4 ' 5' T ' 75&8 4 * +' B $. ' . ' S * T #$7' G# . ' 7 ' 5 ' ! !' G8' 5& ' 7 ' BG8' NG88 +' G&+' 55O' 7 ' $&' G #' N#G7 8' B . 4 ' . G ' 7 ' BG8' $&' 547 ' G ' . ' $9 ' 5 ' $ 8' NG88$& ' ' 1 G&+' G8' 4 ' G4+8' &' #G&+ ' . 8 ' B 5' 7 8' 5 ' . 4' 75&8 $ * +' * & $# ! / ' . ' N4$&7$NG# 8G&$ G4P' # ' $8#G $5&' 5&' . ' 8 G * ' T55O

. 4 ' 5#5B +' . 5B % 4' B $. $&' . ' & Y &' P G48' 9 G&P' N * T #$7' 7 8' . G%$& ' ' 8G&$ G4P' 5T> 7 8 ' 859 ' GNN#P$& ' ' #5' G# ' G&+' 859 ' 5' NG4 $7 * #G4 ' NG4 8' 5 ' . ' ^&$ +' Z&& ' +5 9 ' T 8$+ 8' & * 9 45 * 8' 5 . 4' 7 8' 5 ' #57G# GNN#$7G $5&' A ' & +' 5&#P' &5 < ' 8N 7$G##P' 4 4' 5' 5& ' 5 ' . 8 ' N * T #$7' 8 G * 8' . ' G&$ G4P' 7 ' 5 ' ! : : ' B . $7 . ' BG8' N45TGT#P' #$ ' 9 58 ' $9 N54 G& ' G&+' GNN#$ +' $&' NG4 ' G ' # G8 ' 5' & ' #G&+ ' 75 #G&+' G&+' 4 #G&+ ' . $8' 7 ' G9 5& ' 8 ' 5 . 4' . $& ' 8 ' Y &+ +' . ' N5B 48' 5 ' #57G# G * . 54$ $ 8' 54' . ' +$8N58G# 5 ' 8 BG' ' G&+' $&' G9 &+$& ' ' . ' & ' #$8 . ' * $8G&7 8' 9 5%G# 7 8' 5 ' ! 22' G&+' ! : ' G++ +' 5' . ' + $&$ $5&8' 5 ' & * $8G&7 8' 8N 7$G##P' G8' 4 ' G4+8' 745B + +' . 5 * 8 8' G&+' B 54Od 8.5N8 ' G&+' 5' . ' + * $ 8' G&+' N5B 48' 5 ' #57G# G * . 54$ $ 8' 54' . $4' GTG 9 & ' 8N 7$G##P' 9 ' . ' BGP' 5 ' N45%$+$& ' ' 9 G&8' 54' + 8& 7 $5&' G&+' N#G7 8' 54' . ' 4 7 N $5&' 5 ' + G+' T5+$ 8

&' ! : /' . ' S * T #$7' G# . ' [75 #G&+ ' 7 ' BG8' NG88 +' G' 759 N4 . &8$% ' 9 G8 * 4 ' B . $7 . ' 75&85#$+G +' $& 5' 5& ' 7 ' B $. ' 7 4 G$&' G9 &+9 & 8' . ' B . 5# ' 8 G * ' #GB' 4 #G $&' ' 5' . ' N * T #$7' . G# . ' $&' 75 #G&+

&' ! / ' G' 759 N# ' +$8 4$T * $5&' 5 ' &' #G&+' $& 5' 8G&$ G4P' + $8 4$7 8' 55O' N#G7 ' G&+' 85$#$ ' * 4 . 4' G9 &+9 & 8' B 4 ' 9 G+ ' $&' . ' 8G&$ G4P' #GB8 ' &' ! / 2' . 8 ' #GB8' B 4 ' 75&85#$+G +' $&' . ' 7 ' 5 ' . G ' P G4 ' &' ! " ' G' G&$ G4P' 7 ' BG8' NG88 +' 4 #G $&' ' 5' . ' 9 45N5#$8

&' ! / ' G&' 7 ' BG8' NG88 +' 54' 4 #G&+' 75& G$&$&' ' 8&T8 G& $G ^ P' . ' 8G9 ' N45%$8$5&8' G8' . 58 ' B . $7 . ' G+' T &' &G7 +' $&' . ' 7G8 ' 5 ' &' #G&+' $&' ! /

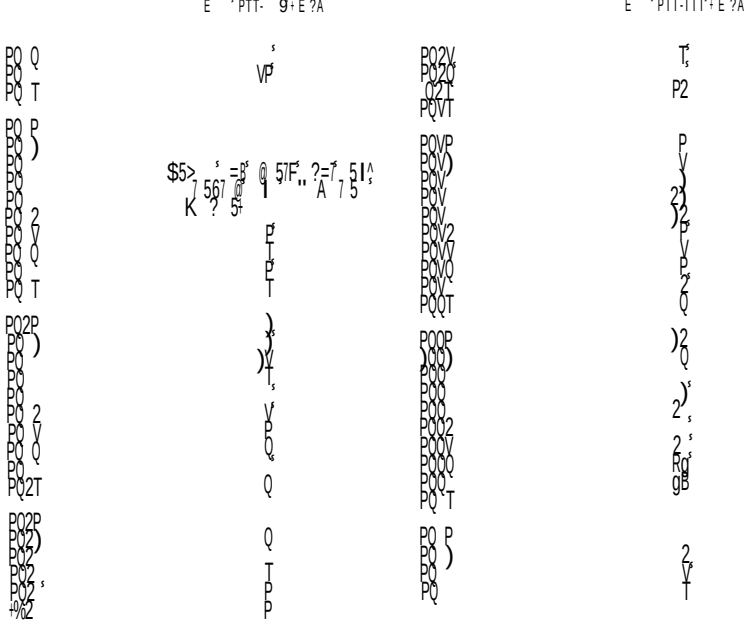
20 ' A ' . G% ' 8 &' . &' . G ' $ ' 859 ' 7 . G&' 8' . G% ' 577 * 44 +' &+$&' ' 5' +$9 $&$8 . ' 9 54 G$ P' 459 ' 89 G# N5Y ' 5 . 4' 7 . G&' 8' . G% ' T &' 8$9 * # G& 5 * 8#P' $&' N45 ' 4 88' &+$&' ' $&' . ' 75& 4G4P' +$4 7 $5&' < ' +5' & 5 ' . $&O' $ ' N588$T# ' 5' 8 4$O ' . ' TG#G&7 ' T B &

. ' B 5 ' G&+' G88 4 ' . G ' $ ' B 5 * #+' #' 5' G%5 * 4' 5 ' G' 8 9 G# 4' 9 54 G#$ P ' &' 8GP$&' ' . $8' B '+5' &5 ' 9 G&' 5' $&+$7G ' G&' 5N$&$5&' . G ' 8G&$ G4P' $9 N45% 9 & 8' . G% ' T &' B $. 5 * ' G&' 7 ' 5&' 8 9 G^ N5Y' 9 54 G#$ P ' T * ' 5&#P' . G ' B . &' G#' . ' 7 . G&' 8' B . $7 . ' . G% ' 577 * 44 +' G4 ' 75&8$+ 4 +' $ ' 7G&&5 ' T ' G88 4 +' . G ' . P' G 54+' G&' G+ E * G ' YN#G&G $5&' 5 ' . ' +$9 $&$8 . +' 9 54 G#$ P' 45 9 ' 8 9 G^ N5Y

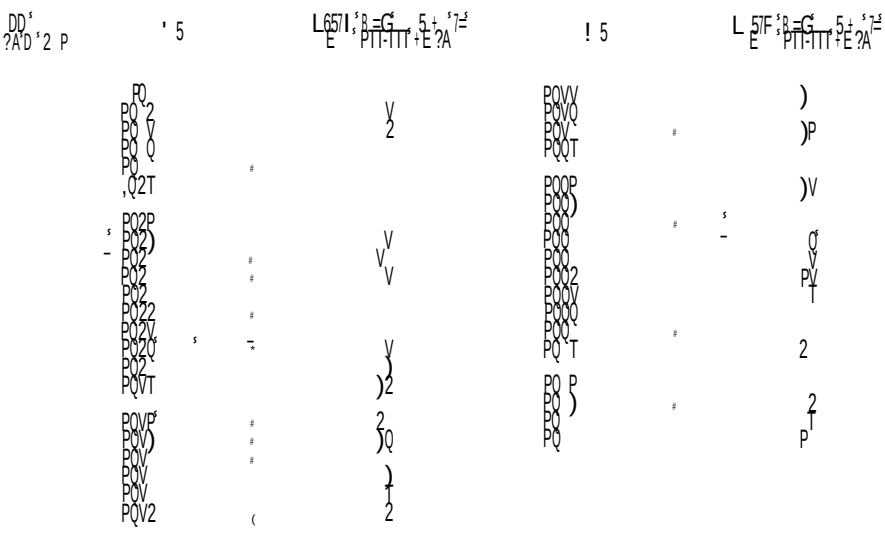
: ' ' . 5B % 4 ' $9 N45% +' 8G&$ G4P' 75&+$ $5&8' B 4 ' . ' 7G * 8 ' 5 ' . ' 9 54 G#$ P' 45 9 ' 8 9 G# N5Y' T 75 9 $&'' # 88 ' B ' 8 . 5 * #+' YN 7 ' 5' 8 ' . G ' . P' . G+' Y 47$8 +' G' 8$9 $#G4' $& #* &7 ' 5% 4' G#$ 9 58 ' G#' 5 . 4' +$8 G8 8 ' < . P' 8 . 5 * #+' . P' &5 ' N45 + * 7 ' . ' 8G9 ' 7 ' $&' . ' 7G8 ' 5 ' 9 G8# 8 ' 87G4# ' % 4 ' B . 55N$&' 75 * ' . ' G&+' $&+ +' G&P' +$8 G8 ' 8N4 G+' TP' 75& G ' $5&' 54' $& 7 $5&' G&+' 45 9 ' B . $7 . ' 4 75% 4P' BG8' N588$T# ' ' < . P' 8 . 5 * #+' . P' &5 ' # G+' 5' . 8 ' +$8 G8 8' G#85' N4 %G$#$&' ' # 88 ' G&+' 5' . 58 ' G G7O +' TP' . 9 ' T $&' ' T 4' GT# ' 5' 75 9 TG ' . ' +$8 G8 ',

22 ' < ' . G% ' . G+' N * ' T 54 ' * 8' &5' 8G $8 G7 54P' G&8B 4' 5' . 8 ' E * 8 $5&8 ' ' . G8' $&+ +' T &' * 4 ' +' . G ' B . $#8 ' . ' +$8 G8 8' B ' . G% ' > * 8 ' 9 & $5& +' G#9 58 ' Y7#* 8$% #P' G 7 ' 7 . $#+4 & ' 8 9 G# N5Y' #G4 ' #P' G G7O8' G+ * # 8 ' < ' 7G&&5 ' # . G ' . $8' 7$47 * 9 d 8 G&7 ' $8' 5 ' 9 * 7 . ' B $ ' . ' ' 9 * 8 ' T ' 4 9 9 T 4 +' . G ' $&' 549 4' +GP8' 8 9 G^ N5Y' BG8' 9 54 ' G G# 5' 7 . $#+4 &' . G&' 5' G&P' 5 . 4' 7#G88 ' ? * ' GNG4 ' 45 9 ' . $8' B ' G$#' 5' 8 ' B . P' Å$9 N45% +' 8G&$ G4P' 75&+$ $5&8' 8 . 5 * #+' &GT# ' 7 . $#+4 &' [G&+' G8' B ' . G% ' 8G$+' $ ' $8' G 9 5&' 8 ' . 9 ' . G ' . ' +$9 $&* $5&' 5 ' 8 9 G#$ N5Y' 9 54 G#$ P' . G8' T &' ' 4 G 8 ' 5' 87GN ' G G7O8' 5 ' 8 9 G# N5Y' G&+' 5% 475 9 ' . ' +$8 G8 ' 4G . 4' . G&' 5' 87GN ' 45 9 ' G&+' 5% 475 9 ' G&P' 5 ' . ' 5 . 4' +$8 G8 8' 5' B . $7 . ' B ' . G% ' 4 44 +

2 : ' &' . ' 7G8 ' 5 ' 9 G8# 8' . 4 ' . G8' &5 ' T &' + * 4$&' ' . ' N 4$5 +' $&' E * 8 $5&' G&P' +$9 $&* $5&' $&' . ' 9 54 G#$ P' 7544 8N5&+$&' ' B $. ' . G ' +$8N#GP +' $&' . ' 7G8 ' 5 ' 8 9 G# N5Y . ' 5##5 B $&' ' GT# ' 8 . 5 B 8' . ' 9 54 G#$ P' 45 9 ' 9 G8# 8' $&' &' #G&+' G&+' < G# 8' + * 4$&' ' G7 . ' 5 ' . ' P G48' ! 0 ! ! ' G&+' ! / ! " ' . ' $' * 4 8' 54' . ' P G48' ! 0 ' ! :' G4 ' &5 ' G%G$#GT#

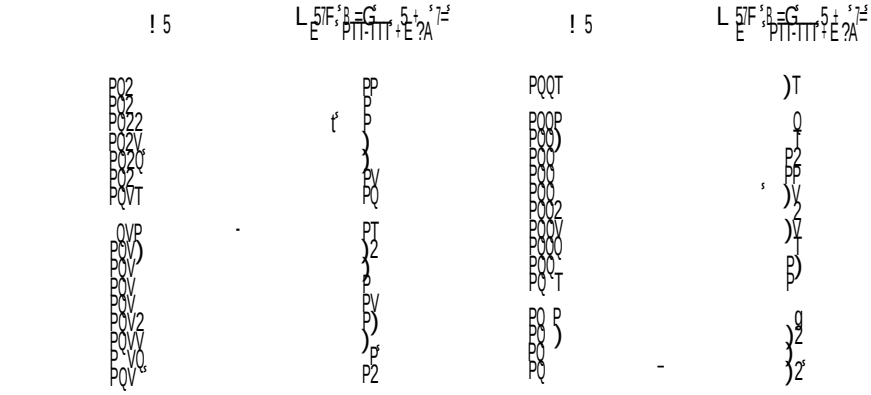


: / ' . ' 5 ##5 B $& ' ' GT# ' '8 . 5 B 8' . ' 9 54 G#$ P' 45 9 ' 9 G8# 8' $&' 75 #G & +' + * 4$& ' ' G7.' 5 ' . ' P G48' ! : 2 " Q ('



2! ' 345 9 ' . ' 4 N54 ' 5&' . ' 7 &8 * 8' 5 ' 4 #G & +' $&' ! : ' [SG4 ' '%5 #' ' NG ' ' ' B ' G4 ' GT# ' ' 5' 5T G$&' . ' & * 9 T 4' 5 ' + G . 8' 45 9 ' 9 G8# 8' G87 4 G$& +' TP' . ' 7 &8 * 8' $& E * 4 8' 5' . G% ' 555 * 4 +' $&' 4 #G & +' + * 4$& ' ' G7.' 5 ' . ' $& 4 5 &8G# N 4$5 + 8' ! 0 ' ! 2 ' G & +' ! 2 : ' G#7 * #G $& ' ' 45 9 ' . 8 ' $' * 4 8' . ' G% 4G ' ' G & & * G# + G . 4G ' + * 4$& ' ' G7.' 5 ' . 8 ' N 4$5 + 8' 45 9 ' 9 G8# 8 ' $&' . ' 8G 9 ' B GP' G8' . ' G% 4G ' ' G & & * G# + G . 4G 8' 54' . ' 8G 9 ' N 4$5 + 8' 45 9 ' 89 G#$ N5Y' [' $% &' $& ' g ' B 4 ' 7G#7 * #G + ' B ' $& +' . G ' . ' GNN45Y$9 G ' G% 4G ' ' G & & * G# + G . 4G ' 45 9 ' 9 G8# 8' $&' 4 #G & +' N 4' ' #$% $& ' ' B G8' 0 ! ' + * 4$& ' ' . ' $& 4 7 &8G# N 4$5 + ' ! 0 ' ! ! ' G ' G$&' + * 4$& ' ' . ' $& 4 5 &8G# N 4$5 + ' ! 2 ' G & +' ' + * 4$& ' ' . ' $& 7 &8G# N 4$5 + ' ! 2 :

. ' 9 G 4$G#8' 54' . ' 5 ##5 B $& ' ' GT# ' 8 . 5 B $& ' ' . ' 9 54 G#$ P' 45 9 ' 9 G8# 8' $&' 4 #G & +' + * 4$& ' ' G7.' 5 ' . ' P G48' ! : " ' . G% ' T &' 5 T G$& +' 45 9 ' . ' G & & * G# 4 N54 8' 5 ' . ' ' $8 4G4 V & 4G# 5 ' ? $4 . 8' G & +' = G . 8' $&' 4 #G & +

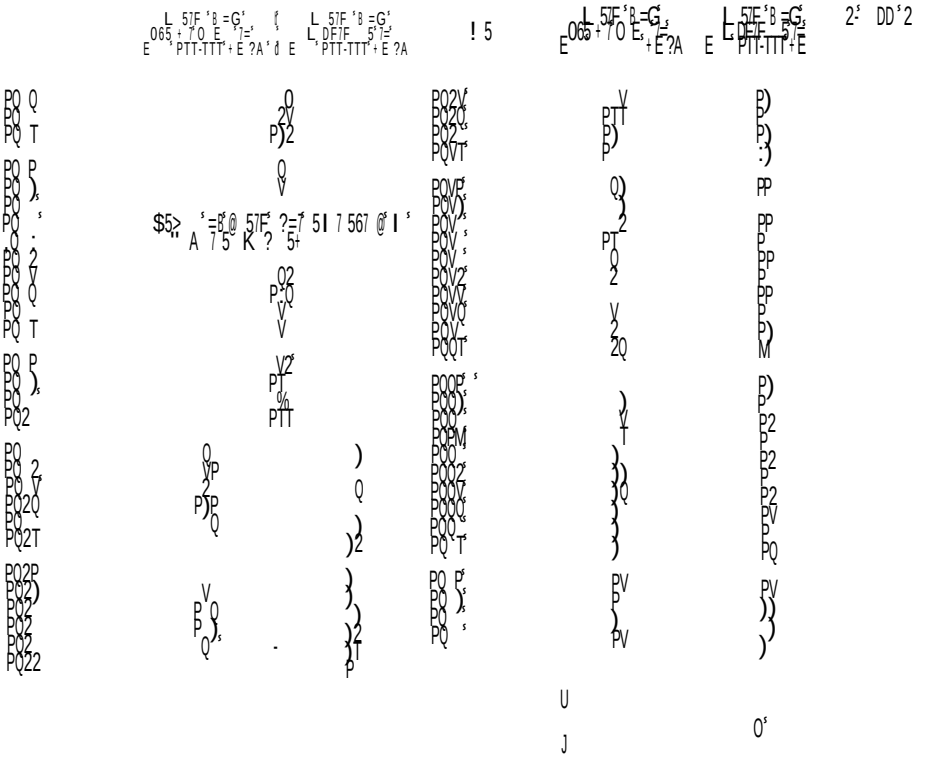


: " ' ' B $^ ' T ' 8 &' . G ' . ' + G $ 4G ' 45 9 ' 9 G8# 8' $&' G #' . 4 ' 75 * & 4$ 8' . G8 ' G8' 9 $' . ' T ' YN 7 + ' %G4$ +' 75&8$+ 4GT#P' 45 9 ' P G4' 5' P G4 ' $. 4' $&' & ' #G & +' G&+' < G# 8 ' & 5 4' $&' 75 #G&+' 54' 4 #G&+ ' . G8' . G ' + G . 4G ' . 5B % 4 ' 8 . 5B &' G&P' $& + $7G $5 &' 5 ' G' + 7#& ' G ' G #' 75 9 NG4GT# ' B $. ' . ' + 7#& ' $&' . ' + G . 4G ' 45 9 ' 8 9 G# N5Y' B . $7 . ' . G8' + $8 $& ' * $8 . +' . ' N 4$5 +' &5B ' * & + 4' 75&8$+ 4G $5& ' %$I ' $&' & ' #G & +' G&+' < G# 8' . ' N 4$5 +' 45 9 ' ! 0 !' 5&BG4+ ' $&' 75 #G&+' 45 9 ' ! : 2' 5&BG4+ ' G&+' $&' 4 #G&+' 45 9 '

< ' $& + ' $& + + ' G8' 4 ' G4+8' & ' #G&+' G&+' < G# 8 ' . G ' . 5 * ' . ' . ' + G . 4G ' 45 9 ' 9 G8# 8' BG8' . $' . 4' $&' . ' . 4 ' P G48' ! 0 ! ' ! 0 "' G&+' ! ' . G&' $ ' . G8' T &' $&' G&P' . 4 ' 75&8 7 * % ' P G48' 8 $& 7 ' . 4 ' . G8' T &' &5' 9 G 4$G# + 7. & ' $&' . G ' + G . ' 4G ' + * 4$& ' ' . ' P G48' ! 0 ! " ' 8' 4 ' G4+8' 75 #G&+ ' B ' $& + ' . G ' . 4 ' . G8' T &' &5' 9 G 4$G# + 7#& ' $&' . ' + G . 4G ' 45 9 ' 9 G8# 8' + * 4$& ' ' . ' P G48' ! 22 " ' 8' 4 ' G4+8' 4 #G&+' B ' $& + ' . G ' . ' + G . 4G ' 45 9 ' 9 G8# 8' BG8' 5&' . ' B . 5# ' 75&8$+ 4GT#P' # 88' + * 4$& ' ' . ' $& 4 + & G# N 4$5 +' ! 2 : ' . G&' + * 4$& ' ' . ' G4#$ 4' $& 4 5 &8G# N 4$5 + 8' ! 0 ' G&+' ! 2 ' T * ' . G ' . 4 ' . G8' 8$& 7 ' T &' &5' 9 G 4$G# + 7#& ' $&' . G ' + G . ' 4G

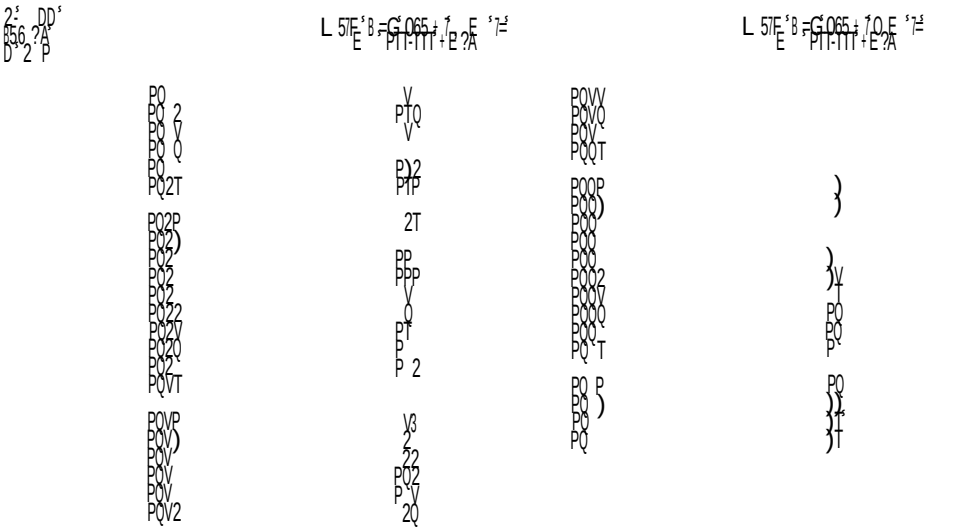
: ' . ' 5 G# 7 ' . & ' 5 ' . ' 7 . G&' 8' $&' 8G&$ G4P' 75&+ $ $5&8' 5' B . $7 . ' B ' . G% ' 4 44 +' 5&' . ' 9 54 G#$ P' 45 9 ' 9 G8# 8' B 5 * #+' 8 9 ' $&' & ' #G&+' G&+' < G# 8' G&+' $&' 75 #G&+ ' 5' . G% ' T &' 87G47 #P' GNN4 7$GT# X G&+' $&' 4 #G&+' 5' . G% ' ÁT &' #$9 $ +' 5' G' + 7#& ' $&' . ' + G . 4G ' 4$ #& ' ' $&' G 9 5 * & ' $&' 75 9 NG4$85&' B $. ' . ' + 7#& ' $&' . ' + G . 4G ' 45 9 ' 8 9 G# N5Y ' G&+' 9 G&$ 8 +' 9 54 5% 4 ' + * 4$& ' ' G' NG4 ' 5&#P' 5 ' . ' N 4$5 +' 5 ' . G ' + 7#&

: ' . ' 5 ##5 B $& ' ' GT# ' 8 . 5B8' . ' 9 54 G#$ P' 45 9 ' 87G4# ' % 4' G&+' 45 9 ' + $N . . 4$G' $&' & ' #G & +' G&+' < G# 8' + * 4$& ' ' G7 . ' 5 ' . ' P G48' ! 0 ! ! ' G&+' ! / ! " ' < ' G4 ' * & GT# ' 54' . ' G4#$ 4' P G48' $& 7#* + +' $&' . ' GT# ' 5' 8 NG4G ' . 58 ' 7G * 8 8' 5 ' + G .

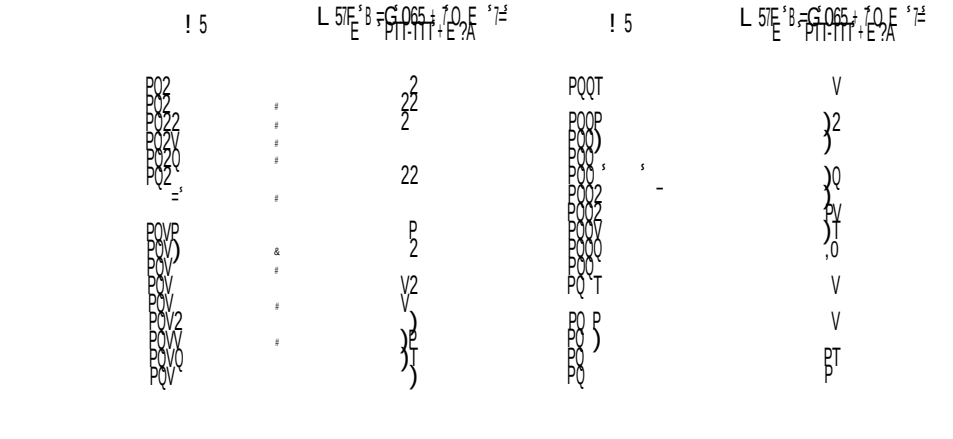


]]' ' " ! 8 $,00, # # N $$,# ', #

: ' #$ ' 5##5 B $&' ' GT# ' 8.5B8' . ' 9 547G#$ hC 45 9 ' 87G4# ' % 4'$&' 75 #G&+' + * 4$&' ' G7.' 5 ' . ' P G48' ! 2 2 " ' Q (



: 0 ' 8' 4 ' G4+8' 4 #G&+ ' 5T G$&$&' ' 45 9 ' . ' 4 N54 ' 5&' . ' 7 &8*8' $&' ! : ' . ' & * 9 T 4' 5 ' + G . 8' 45 9 ' 87G4# ' % 4' G87 4 G$& +' TP' . ' 7 &8*8' $&E * 4 8' 5' . G% ' 577 * 44 +' + * 4$&' ' G7.' 5 ' . ' $& 4 7 &8G# N 4$5+8' ! 0 ! 2 ' G&+' ! 2 : ' G&+' 7G#7 * #G $&' ' G8' T 54 ' 45 9 ' . 8 ' $' * 4 8' . ' G% 4G ' ' G&&*G# + G . 4G ' + * 4$&' ' G7.' N 4$5+ ' B ' $&+' . G ' . ' GNN45Y$9 G ' G% 4G ' ' G&&*G# + G . 4G ' 45 9 ' 87G4# ' % 4' N 4 ' #$% $& ' ' B G8' ' + * 4$&' ' . ' $& 4 7 &8G# N 4$5+' ! 0 ' :' + * 4$&' ' . ' $& 4 ' 7t &8G# N 4$5+' ! 2 ' G&+' 0' + * 4$&' ' . ' $& 4 7 &8G# N 4$5+' ! 2 : . ' 9 G 4$G#8' 54' . ' 5##5 B $&' ' GT# ' 8.5B $&' ' . ' 9 54 G#$ P' 45 9 ' 87G4# ' % 4'$&' 4 #G&+' + * 4$&' ' G7.' 5 ' . ' P G48' ! : " ' . G% ' T &' 5T G$& +' 45 9 ' . ' G&&*G# 4 N54 8' 5 ' . ' ' $8 4G4 V4 & 4G# 5 ' ? $4 . 8' G&+' = G . 8' $&' 4 #G&+' Q (



: ' ' B $## T ' 8 &' . G ' . ' + G . 4G ' 45 9 ' 87G4# ' % 4' $&' G ## . 4 ' 75 * & 4$ 8' . G8' %G4$ +' 75&8$+ 4GT#P' 45 9 ' P G4' 5' P G4' #@ $. 4' $&' &' #G&+' G&+L < G# 8' &54' $&' 75 #G&+' 54' 4 #G&+' . G8' . G ' + G . 4G ' . 5B % 4' Y . T +' G' + 7#$& ' 75 9 NG4GT# ' B $. ' . ' + 7#& ' $&' . ' + G . 4G ' 45 9 ' 89 G# N5Y' B . $7 . ' . G8' + $8 $&' * $8 . +' . ' N 4$5+' &5B ' * &+ 4

75&8$7$ $cG $5& ' %$I '$&' &'#G&+'G&+'<G# $,' . ' N 4$5+' 459' ! 2 ' 5&BG4+'$&' T55 #G&+' 459' !:2' 5&BG4+'G&+'$&' 4 #G&+' 459' !

< ' $&+'$&+ +' .G'$&' &'#G&+'G&+'<G# 8'$&'T75 #G*+'G&+'$&' 4 #G&+' . 4 'BG8' &5'8$'&'5'G&P'+ 74 G8 '$&' . '+ G . 4G ' 459'87G4# ' % 4'*& $# GT5*' !! '54'8.54 #P' T 54 ' .G'P G4' =*4$&'' . '#G8 ' '5' 'P G48' . 4'.G8' *&+5*T +#P'T &' $&' G7.' NG4'5' . '^&$ +'Z$&'+59'G'9G4O +'+ 7#$& '$&' .G'+ G . 4G ' < '.$&O' .G' . ' 8 N8'B.$7.'.G% 'T &' GO &'$&'%G4$5*8'BGP8' 5'$85#G 'N 485&8' 8* 4$&'' 459' 87G4# ' % 4'.G% '#G4' #P'75& 4$T* +' 5' .$8'+ 7#$&

::' < '+5'&5' .$&O'$'& 7 88G4P' 5' T*4+ &' 5*4' 4 N54'B$.' 8$9 $#G4' + G$#8' $&' 4 4 &7' 5' . '9 54 G#$ P' 459'B.55N$&' 75*'.'+*4$&'' . 'N 4$5+'*&+ 4' +$87*88$5&' 'B $#' T '8* 7 &' 5' 8GP' .G' . 4'.G8' T &'&5' + 7#$& '$&' . '9 54 G#$ P' 459' .G' +$8 G8 '7544 8N5&+$&''B$.' . '+ 7#$& '$&'89 G# N5Y'9 54 G#$ P

::' D 4 G'84 88'.G8'T &'#G$+'5&' . ' G7' .G' . '4 754+8'5' . '? '$8 4G4 D & 4G# 8.5B' .G' . '9 54 G#$ P'4 *4& +'*&+ 4' . '. G+'-' % 48'a' .G8'% 4P'#G4' #P'+$9 $&$8. +' ?*'$'$8'&5 54$5*8' .G'$&'759 NG4G $% #P'4 7 &'P G48' .'&59 &7#G *4 'G&+'7#G88$ $7G $5&' 5'+$8 G8 8' B. 4' % 4'$8' N4 8 &'.G% '*&+ 4'5& ''4 G'7.G&' 8'5B$&'' 5'$9 N45% +' +$G'&58$8' &' .'7G8'5' 9 G&P'8*7.'+$8 G8 8'B. 4' . '7G*8'5'+ G .'BG8' 549 4#P' 4 *4& +'9 4 #P'G8'-' % 4 a'$'$8'&5B'G 4$T* +' 5'85 9 '5 .4'+$8 G8 '8 NG4G #P'8N 7$$+' . 'GNNG4 &'+$9 $&* $5&' $8' . 4 54' &5' & $4 #P'G' 4 G# 5& ' .G&' 8' $&' &59 &d 7#G *4 ' G&+' 7#G88$ $7G $5&' .5B % 4' 7G&&5' B .5##P' YN#G$&' . '+$9 $&* $5&' $&' . ' &*9 T 4' 5'+ G .8' 4 *4& +'G8' +*' 5' % 4' .5*'.' . P'N4 % &' YG7'E*G& $ G $% ' 759 NG4$85&' 8*7.' G8' 7G&' T '9 G+ ' $&' . '7G8 ' 5' +$8 G8 8' #$O ' 89 G# N5Y' 9 G8# 8' 65' . '9 54 G#$ P' 459' % 48' .G8' *&+5*T +#P'+ 74 G8 +' #G4' #P' &' 75&8$+ 4$&'' . '4 #G $5&' 5' .$8'+ 74 G8 ' 5'$9 N45% +' 8G&$ G4P'75&+$ $5&8 ' $ ' $8' $9 N54 G&' 5'G+% 4' 5' . '&G *4 ' 5' . 8 ' 8G&$ G4P' $9 N45% 9 & 8 ' . P' 9 GP' T ' T45G+#P' 7#G88 +' G8' 5##5 B 8X([G' =4G&G' '$&7#*+$&''$&' . ' 49' . '4 9 5%G# 5' 9 5$8 *4 ' 459' +G 9 N' G&+'8BG 9 NP'N#G7 8'G&+' . 'G+ E*G #P'4GN$+' G&+' 7*G#4 9 5%G# 5' . ' Y74 G'5' . 'T5B #8' G&+' . 'O$+& P8'' J' & $#G $5&' 5'+B ##$&'8'54' . '4GN$+'G&+' 7 $% ' 4 & BG# 5' . 'G$4' 8*445*&+$&'' . ' $&.GT$G& 8' [7' $'. $&''5'+B ##$&'8' . ' 9 G&8' GO &' 5' 8 7*4' .$8' G#85' & G$# '4 G 4' % & $#G $5&X . ' B5' '5' 5' . 4'T*' T 8$+ 8' .$8' . ' 7'5' #$'. ' G&' 54'G&$8 9 8' 54' 9 $745T 8' 5' B .$7.' 55& G'$G' 8 9' G&G#5'5*8'B5*#+'# G+',5&,' 5'8*NN58' .G' $&74 G8 +'#$'. 'G'# G8'8*&#$'. ' &+ +'5' + 8 45P'55& G'$G' & ' 8*NN#P'5'N*4'BG 4' 54' +4$&O$&''N*4N58 8' pLC S 485&G# 7# G&#$& 88' .$8'GNG4'459'$8'$& #* &7'5&'' & 4G#. G# .'B5*#+'.G%'G' &+ &7P'5' 4 &+ 4'G&' $&+$%$+*G# # 88' #$O #P'5'4 7 $% ' 75& G'$5&' G&+'# 88' #$O #P'5'75&% P'$'5' G&5 . 4' [`' . '$&74 G8 +' ' & 4G# 4 75'&$ $5&' +*4$&'' . '#G8 ' 54' ' P G48' 8N 7$G##P'5'75& G'$5&'G8' . '85*47'5'7 4 G$&' +$8 G8 8'G&+' $&74 G8 +' O&5B# +' ' ' . '9 G&8'5'G%5$+$&''$8' 8N4 G+'9 GP'T'4 75'&$8 +'G8'G' 8G&$ G4P'$9 N45% 9 &'5'&5' 8#$' . '%G#* ' '$8' 5T%$5*8' .G' . 8' 8G&$ G4P'7.G&' 8' G4'&5' 7G#7*#G +' 5' G 7' % &' G#' IP9 5 $7'+$8 G8 8'$&' . '8G9 '9 G&& 4'G&+' 5' . '8G9 ' Y & ' . '7.$ ' % 48' G4'[' 9 G#G4$G# % 48'[' PN.*8'[0' PN.5$+' . 4'$8'9*7.'*&7 4 G$& P'75&7 4&$&'' . ' % 4'7#G88 +'G8' -'8$9 N# '75& $&* + a'&54'+5 8' .$8'GNN G4' % 4' 5'.G% '75& 4$T* +' #G4' #P' 5' . '4 *4&8' 5B'9 G#G4$G# % 48'G4'+$4 7 #P'+ N &+ &'5&' . '+ % #5N9 &' 5' . '55& G'G'&'8BG9 N8'G&+'9 G48. 8X B. &' . 8 'G4 'G+ E*G #P'+4G$& +' . ' % 48' +$8GNN G4' PN.*8' % 4'B.$7.'8 98' 5'.G% ' *4&$8. +' . '#G4' 8'8.G4 '5 '-' % 48'a' $&' . '#G8 'G&+' $&' . 'T '$&&$&'' 5' . $8' 7 &*4P'$8' 5*&+' 5' N4 %G$# $&' 75&& Y$5&' B$.' 5% 4745B+$&''$&' +G4O'$## % &$#G +'+B ##$&'8'759 T$& +'B$.'+ 7 &'&* 4$ $5&' < . &' . 8'75&+$ $5&8'7 G8 ' . ' % 4'+$8GNN G48'G&+' PN.*8'.G8' .*8'T 759 'G#9 58' *&O&5B&'$&' #$$8'75*& 4P'G' . 'N4 8 &'+GP' PN.5$+' % 4'$8'+$4 7 #P'+ N &+ &'5&' .'55& G'$G' *4&$8. +'TP' . ' Y74 G'5'5& '7G8 'T $&''$& 45+*7 +'$& 5' . 'G#9 & G4P' 7G&G#' < . 4 ' TP' 9 G&8' 5' G+ E*G ' +4G$&G' ' G&+' N 485&G# 7# G&#$& 88' .$8' $8' N4 % & +' . '+$8 G8 '$8' N4 % & +' G#85' &' . '7G8 '5' G7.'5' . 8' % 48' . &' . 4 'G4 ' 8N 7$G# 7$47*9 8 G&7 8' + % #5N$&'' . '+$8 G8 'B.$7.' 8G&$ G4P'$9 N45% 9 & 8' &+'+$4 7 #P' 5'4 95% ' . 4 '$8'&5'#$O ' G *4 '$&' . '7G8 '5 '89 G# N5Y' '4 8 9 T# 8' 9 G8# 8'$&' .$8' .G' . '8N4 G+'5 '$ '$8'&5 '75&& 7 +'B$.'G&P'NG4 $7 9 G4$8G&$ G4P' G*# ' G8'+$8 $&'*$8. +' 459' .58'' & 4G# 75&+$ $5&8'B.$7.' &+' 5' . '8N4 G+'5 '$& 7 $5*8' +$8 G8 ' . 4 '$8'&5' %$+ &7 $&' . '.$8 54P'5'89 G# N5Y' $. 4'T 54 '54'+*4$&'' . '&$& d & .'7 & *4P' 5'75&& 7'5* T4 GO8'5' . G'+$8 G8 '$&'G'8N 7$G#BGP' $. 4'B$.'$9 N4 4 7' 4 9 5%G#5' Y74 G'54'B$.'#G7O'5' G$4'G&+'#$' . '54' B$.'+ 7 &' 55+'54'B$.' #G7O' 5' N 485&G# 7# G&#$& 88' ;54 5% 4' . '' & 4G# &+ &7P'5' 8G&$ G $5&' 5' #5B 4' . ' N4 %G# &7' G&+' . ' G G#$ P'5' . '+$8 G8 '$8' #G4' #P'& * 4G#$8 +'T5 .'$&' . ' 7G8 '5' 89 G# N5Y' G&+' 9 G8# 8' TP' . '4 G 4' G7$#$ P'5' $& 475*48 ' < .$#8 ' . & ' . 4 '$8

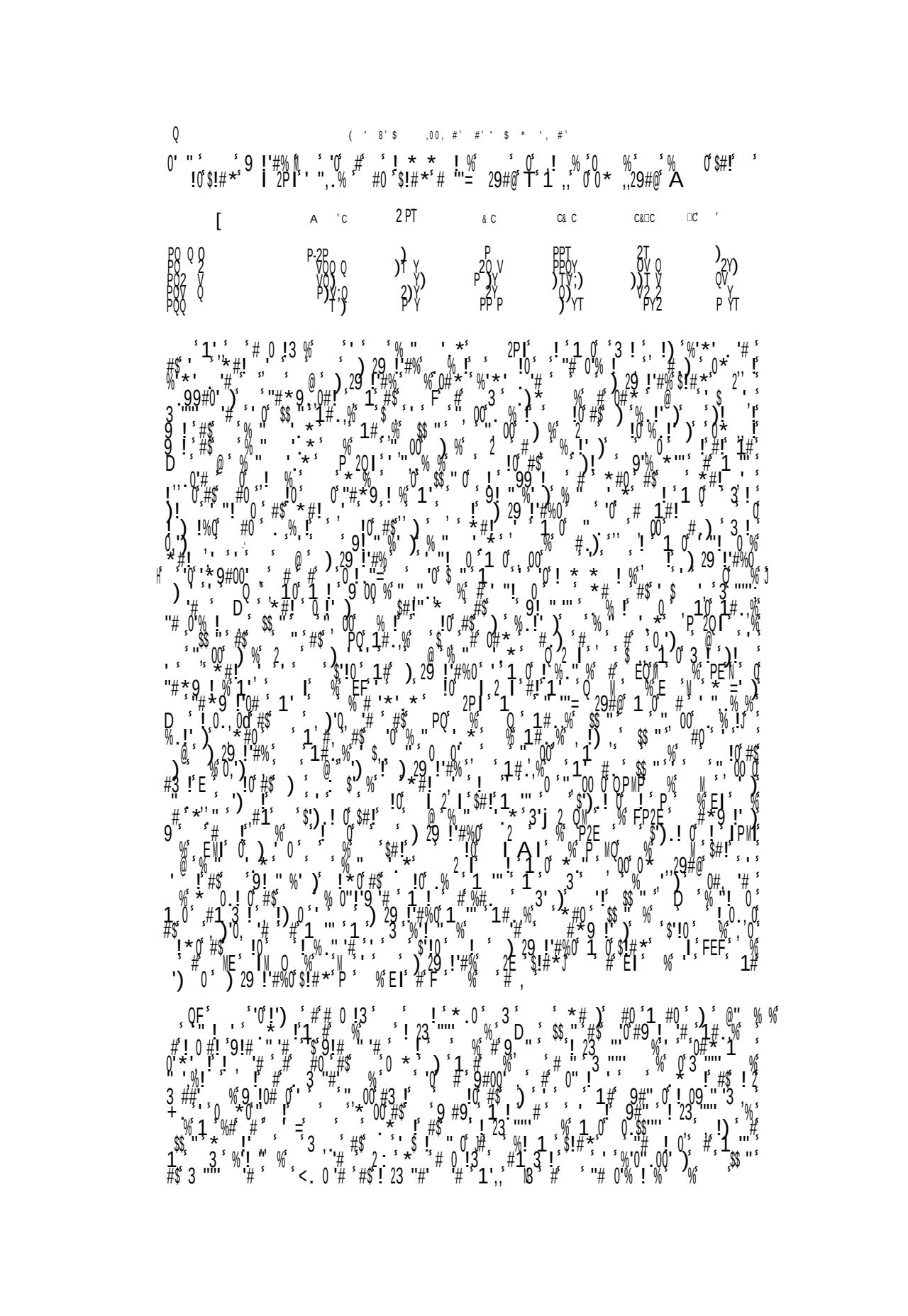
G 9 N# '4 G85&' 5'4 'G4+' . '+ 74 G8 ' $&' . ' 5G8 L5' PN.*8' G&+' PN.5$+' % 4'[G&+'$' 9 GP'N 4.GN8'T '8G$+'5 ' % 4' ' & 4G##P 'G8' . '4 8*#'5 ' $9 N45% +' 8G&$ G4P'75&+$ $5&8' 8$&7 ' G7.'5 ' . 8 '$8' 8N 7$G##P'+ N &+ &'5&' 75&+$ $5&8'B .$7.' 8G&$ G4P'$9 N45% 9 & 8' .G% '4 9 5% +' . 4 '$8'&5'G+ E*G '4 G85&' 5'G 4$T* ' . '+ 74 G8 '5 '8 9 G## N5Y'$&' . ' &$& & .'7 & *4P' 5'G'8$9 $#G4'7G*8 ' .5*'.'B ' *##P'4 75'&$8 ' .G '8G&$ G4P'$9 N45% d 9 & 8' .G% '.G+'G&' 7'$&'4 +*7$&'' . ' 9 54 G#$ P' 459 '8 9 G## N5Y'G8' 459 ' .'5 . 4' +$8 G8 8' 5'B .$7.'B ' .G% '>*8 'T &'4 44$&' ' .$8'%$ B'$8'8 45&'#P' 75& $49 +'TP' . ' G7 ' .G '$&'8N$ ' 5 ' 8G&$ G4P'$9 N45% 9 & 8' . '9 54 G#$ P' 459 '9 G8# 8'G&+'B .55N&&' ' 75*'.'.G8'4 9 G$& +'*.+$9 $&$8. + 'G&+' . ' +$9 $&* $5&' $&' . ' 9 54 G#$ P' 459 '87G4# ' % 4'.G8'5&#P'T &'GNNG4 &'$&'75 9 NG4G $% #P'4 7 &'P G48

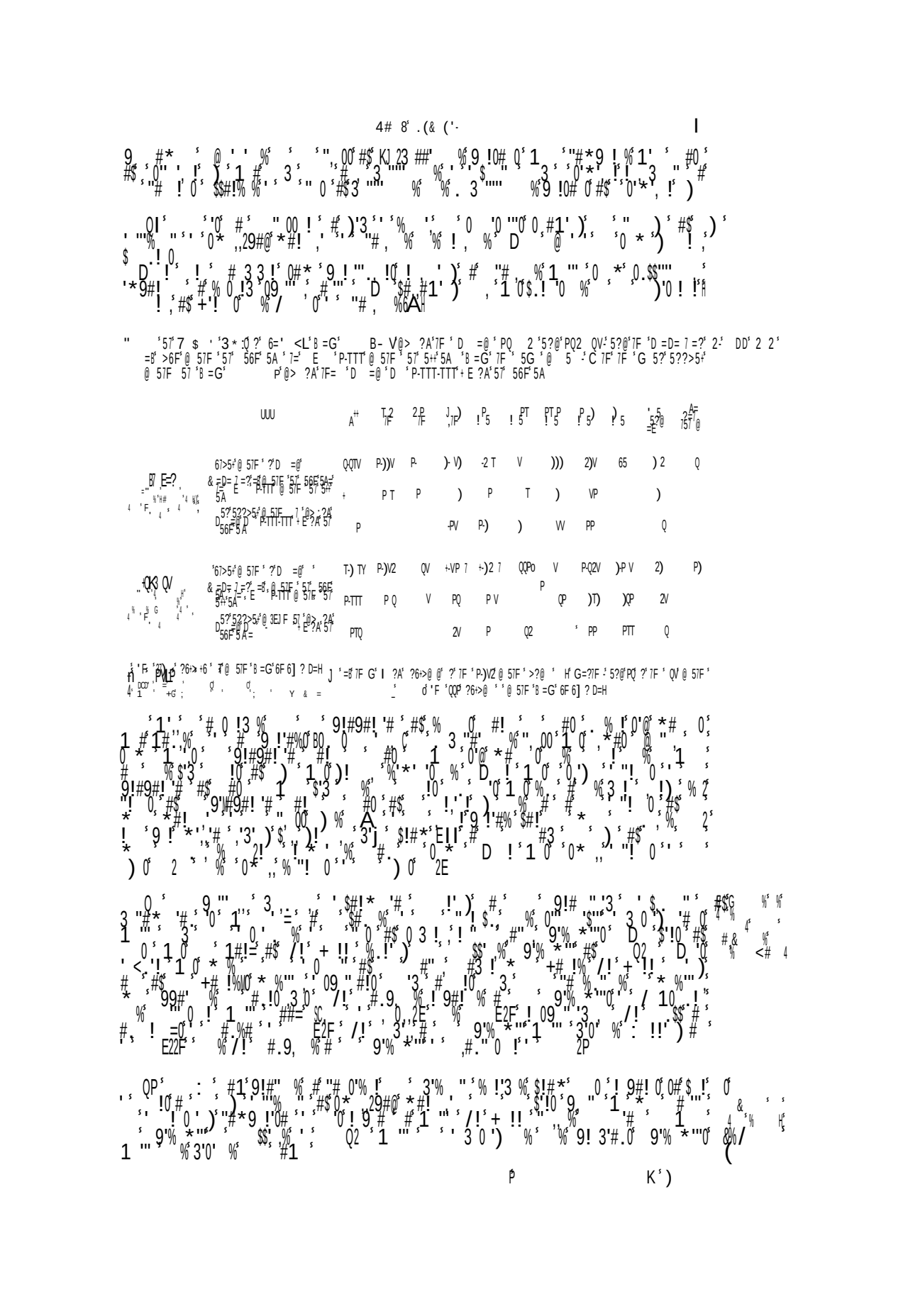
:/' '.G8'T &'9 G$& G$& +' .G' . '+ 7#$& '$&'89 G## N5Y'9 54 G#$ P'$8'#G4' #P'+*' 5' 9 54 ' 4 E* &'G&+'8P8 9 G $7'G 9 N 8' 5'$85#G ' .58 '8* 4$&'' 459 '89 G## N5Y' < ' .$&O'G&'G&8B 4' 5' .$8'75& &$5&'$8' 5'T '5*&+' $&' . ' G7 ' .G 'G8'B '8.G#N4 8 & #P' 8.5B'[gg' : @/" '$'$8'5&#P'$&'E*$ '4 7 &'P G48' .G ' .4 '.G8'T &'G&P'8P8 9 G $7' N4G7 $7 '5 '$85#G $&'' 89 G## N5Y'NG $ & 8'G&+' .G '$ '.G8'T &'75& $& +' % &' .&' 5'G' % 4P'#$9 $ +'&*9 T 4'5 '#57G#$ $ 8' . 'G7 '5'B .$7.'B 'G4 'GT5*' 5'7G#' G & $5&'$&' '4 G 4'+ G$# .G&'.$ .45' .G' .'+ 7#$& '$&' .'+ G .8' 459 '89 G## N5Y'$8' 5*&+' G#9 58' Y7#*8$% #P'G95&'' .58 '5' &+ 4'P G48 'GNN G48' G#85' 5'9 $#$ G 'G'G&8'. '75& & $5&' .'4$8O'5 '75& G'$5&'$8'&5 '75& $& +' 5'7.$#+4 &' +*#8'G#85'G4 '8*T> 7' 5'$ ' 'G'T 4'8P8 9'5 '$85#G $5&'.G+'T &'G'9 G$&'7G*8 '5 '.'4 +*7 +'9 54 G#$ P' B '8.5*#+'.G% ' YN 7 +' 5'8 '$'5N 4G '$&' .'7G8 '5 'G+*#8'G8'B # G8' 5'7.$#+4 &' ' .'8G9 '$9 'B 'G4 'G4' 459 '.$&O$&' 'G8'B $#' GNN G4'B.&'B '759 '5'+ G#B$.' .G '8*T> 7 '.G '. ' 54 8'G '$85#G $5&' B.$7.'.G% '7.G4G7 4$8 +'4 7 &'P G48'.G% 'T &'B$.5*'G'T & 7G# 7'5&'89 G## N5Y'9 54 G#$ P

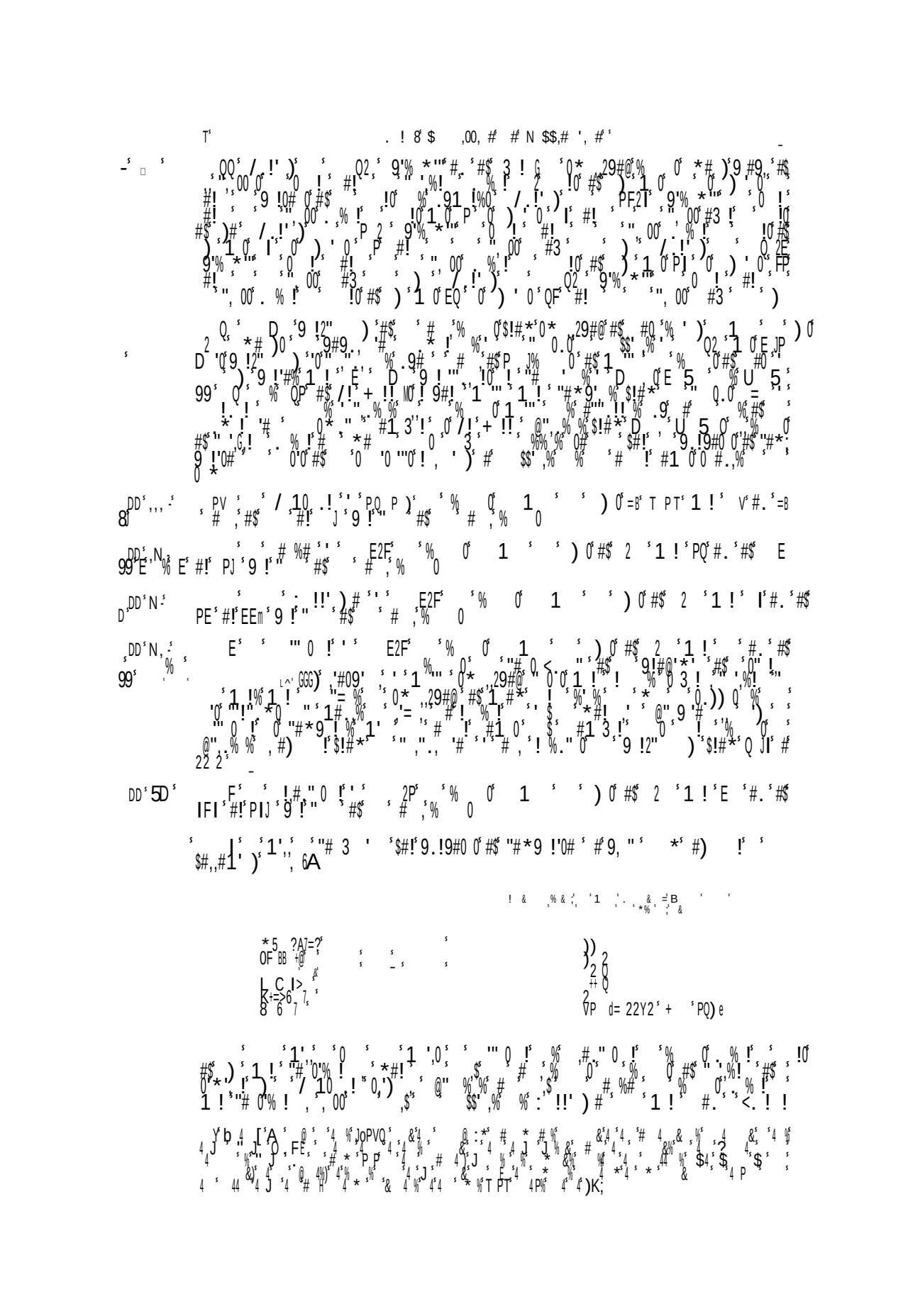
:!' '8 *+P'5 ' .'G' '$&7$+ &7 ' 5'89 G## N5Y'9 54 G#$ P'$8'% 4P'$&8 4*7 $% ' &' 75&& Y$5&'B$.' .$8'N5$& '$'$8'& 7 88G4P' 5'T G4'$&'9 $&+' .G ' YN 4$ &7 '.G8'# +' 5' . 75&7#*8$5&' .G 'B.G % 4' T ' .'N45 7 $% ' 7'5 '%G77$&G $5&' $ '$8' &5 'GT85#* #P' N 49 G& &X .'9 58'75&%$&7 +'G+%57G 8'5' .'N4G7 $7 'G+9 $' .'G 'G 4' .'#GN8 '5 '&$& ' 54' &'P G48' 459 ' .'+G '5 ' .'5N 4G $5&'$8'N45 7 $% ' 7'G'G$&8 'G&'G G7O'5 ' 89 G## N5Y'4GN$+#P'+$9 $&$8. 8'G&+' .G '$ '$8'5&#P'+*4$&'' .$8'N 4$5+' .G '$ 8'N5B 4'$&' .G ' 4 8N 7 '$8' % 4P' '4 G ' .5*'.'$ ' $8' 9 G$& G$& +i' .G '85' G4' G8' 4 'G4+8' $ 8' N5B 4' 5' 9 5+$P' . ' 7.G4G7 4' 5 ' .' +$8 G8 'G&+' 4 &+ 4' $ ' # 88' G G#' $ 8' 7' 4 9 G$&8'$&' *## 547 ' 54' G' #5&' 4' N 4$5+' G&+' & % 4' G# 5' . 4' 7 G8 8' . ' YN 4$ &7 ' *N5&' B.$7.' .$8'%$ B'$8' 5*&+ +' $8' + 4$% +' G#9 58' Y7#*8% #P' 459 ' .' 7G8 ' 5 '$& G& $# '%G77$&G $5&' '.G8'T &'8*NN58 +' TP' 859 ' .G ' .' 4G&8$ 54P'7.G4G7 4' 5 ' .'N45d 7 $5&'4 8*#8' 459 '7.G&' 8'75&& 7 +' B$.' .' '45B .' 459 '$& G&7P' 5'G+*#'P G48' < . . 4' .$8'T '85'54'&5 'B '.G% '&5'9 G&8'5 '+ 49 $&$&'

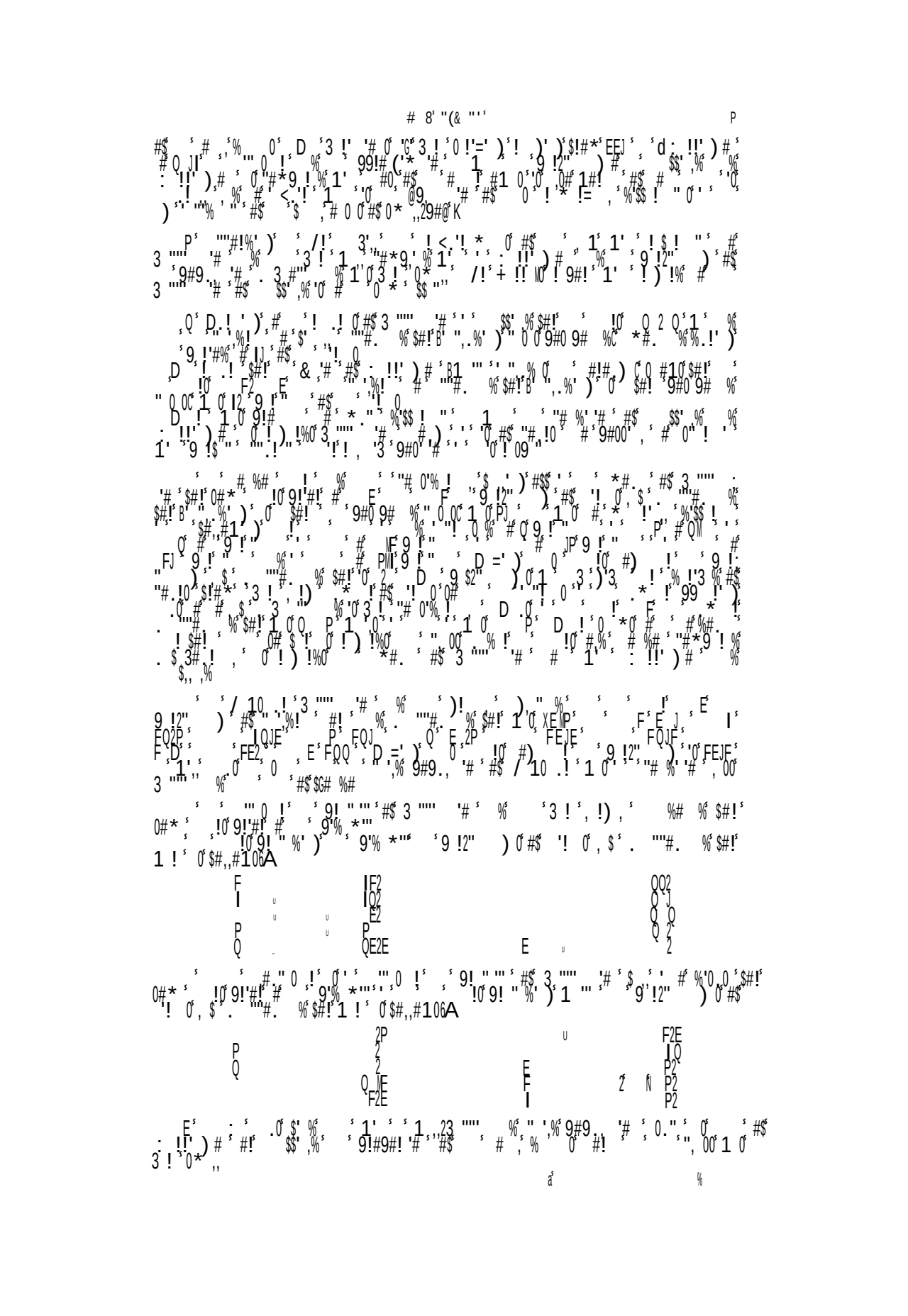
:"' 5'+5*T'B. &') && 4'+4 B' .' G & $5&'5 ' .' N*T#$7' 5' .'%G#* '5 '%G77$d &G $5&' .' T # % +' .G 'G' 8$&'#' 8*77 88 *# $&57*#G $5&' 5 '%G77$&' 9 G 4' 8 7*4 +' GT85#* '$9 9 *&$P' 54' .' * *4 ' 459 'G&' G G7O' 5 '89 G## N5Y' '$8'7 4 G$&' .G '$&' .$8' . 'BG8' 9 $8 GO &' ' 9 GP' B # T ' +5*T +' B. . 4' . ' G& 7NG $5&' BG8' G' 4 G85&GT# '5& ' 5'8*7.'$9 9 *&$P'$8'8 7*4 +'TP'G&'G G7O'5 '84&G## N5Y' .5*'.' . 4 'G4' B'B.5'B5*#+'9 G$& G$&' .'N45N58$ $5&' .G '$ '$8'B $.5*' N45 7 $% ' $& #* &7 'G'G$&8' G&5 . 4'G G7O' ''# ' . 4 'B5*#+' 8 9' 5'T '&5'85*&+' '45*&+' 54' YN 7 $&'' .G' %G77$&$G'B5*#+'G #54+' 9 54 'N5 &'N45 7 $5&' .G&'89 G## N5Y'$8 # ' . ' Y &'5 ' . ' N45 7 $5&'G 54+ +'[G88*9 $&'' .G ' . 4 '$8' 859 ' N45 7 $% ' $& #* &7 '75*#+' 5&#P'T ' + 49 $& +'TP' YN 4$ &7 ' 855&' T 7G9 'GNNG4 &' .G ') && 4' .G+' $&' . ' $48' $&8 G&7 ' 5% 4 4G +' . ' 7' 5 '%G77$&G $5& ' .G ' . ' 8.5*#+' .*8' .G% ' 5% 4d 8 $9 G +'$'$8'&5 ' 5'T 'B5&+ 4 +'G 'B. &' . ' &+ &7P' 5'T '*&+*#P'8G&'*$& 'B.$7.' T 8 8' . ' +$875% 4 4'5 ' G&P'& B'N45N.P#G7 $7 'G&+'$&+ +' % 4P'+$875% 4 4'$8' T54&' $&' 9 $&+

" ' * &' * H ; Q & 4 '% ' # / ' . ' G7 '.G8'T &'G#4 G+P' &5 +' .G '$&' . ' $'. & .' 7 & *4P'[G&+' . 4 ' $8' &5' 8G $8 G7 54P' %$+ &7 ' .G ' . 4 ' BG8'G' +$ 4 &7 '$&' .$8' 4 8N 7 '$&' G4#$ 4' 7 & *4$ 8 '89 G## N5Y'BG8' G G#7.$ #P' 5'7.$#+4 &X $&+ +'$&'NG4 $7*#G4'#57G#' N$+ 9 $78' 5 'B.$7.'B '.G% '4 754+8' . '9 54 G#$ P'BG8'75& $& +' & $4 #P'54'G#9 58' & $4 #P' 5' .G ' 7#G88'5' . 'N5N*#G $5&' +*#8'B 4 'G' .G ' $9 '% 4P'#G4' #P'N45 7 +'TP'G'N4 %$5*8' G44G7O'5 '89 G## N5Y' .$#+4 &'B 4 '. &C . 5&#P'7#G88' 54' .'9 58 'NG4 '*&N45 7 +' =*4$&'' .'N4 8 &'7 & *4P' .$8' 7G*8 '5 'N45 7 $5&' .G8'#G4' #P'+$9 $&$8. +'X $ '$8' &5B' 5&#P'G'% 4P'89 G## 8 +$5&'5 ' .'759 9 *&$P'B.$7.' &>5P8' N45 7 $5&' .*8' G7E*$4 +' ' . &'%G77$&G $5&' T '9 58'N5 &'$&' $8' 7' +*4$&'' . ' $48 ' <'P G48' G 4









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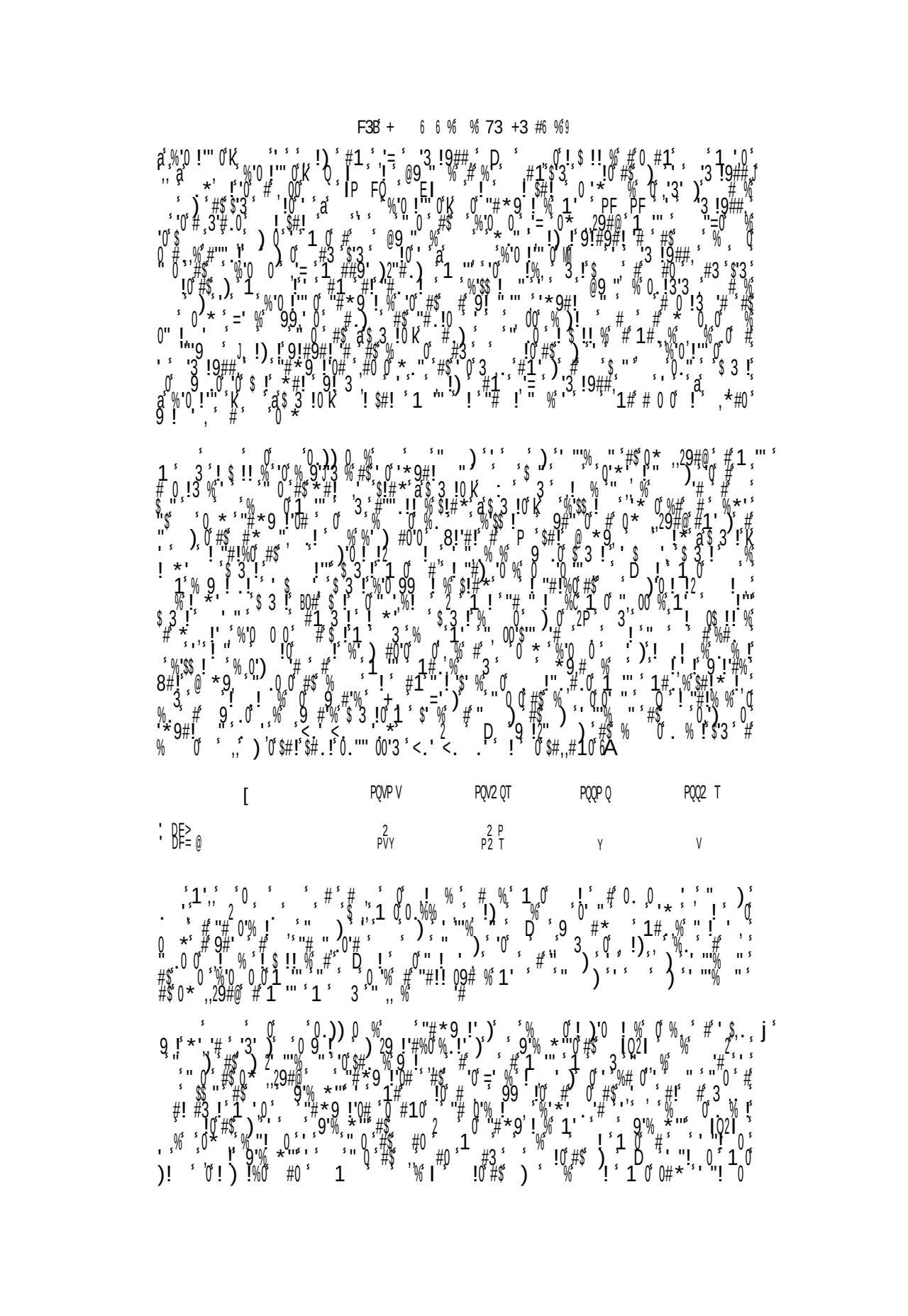

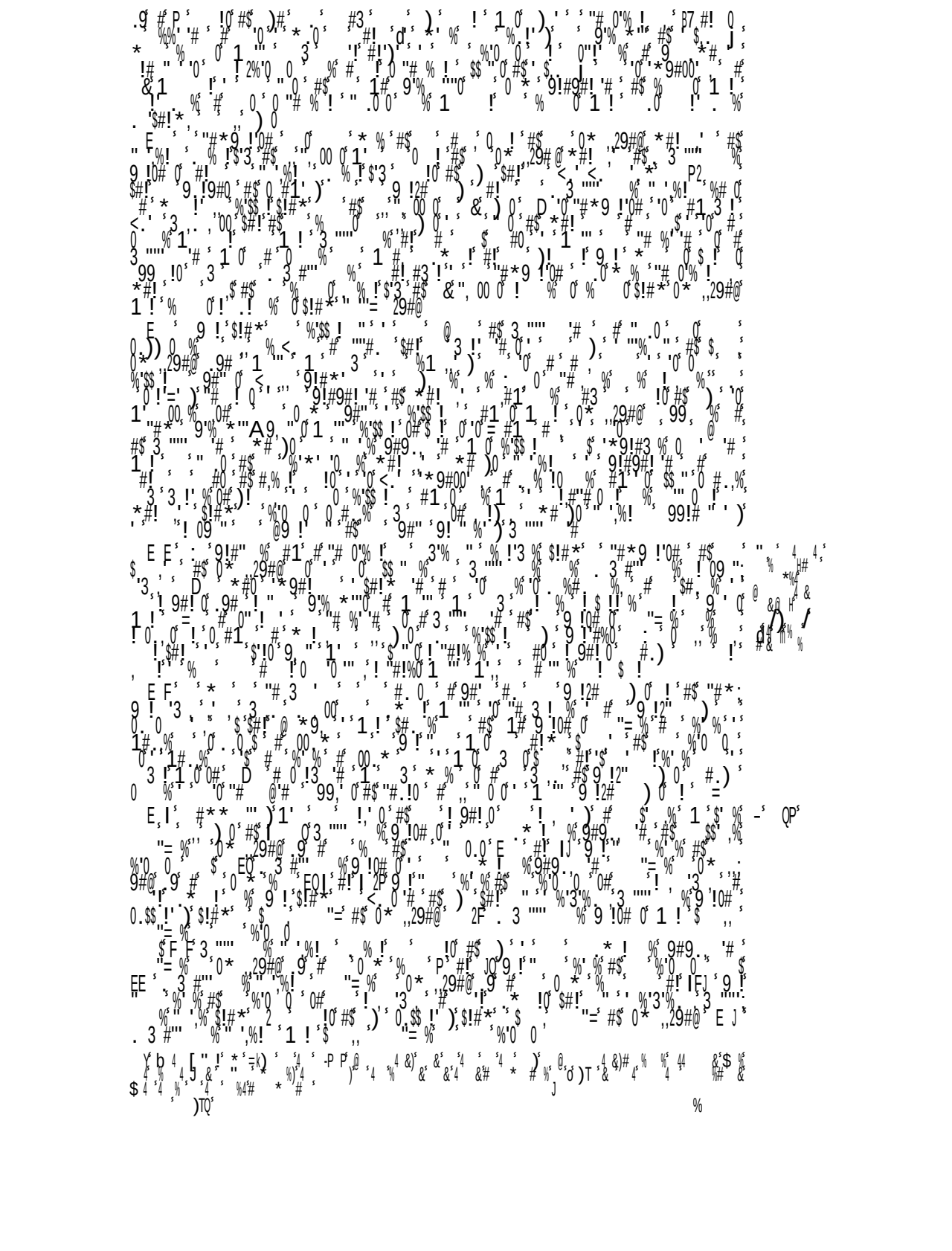

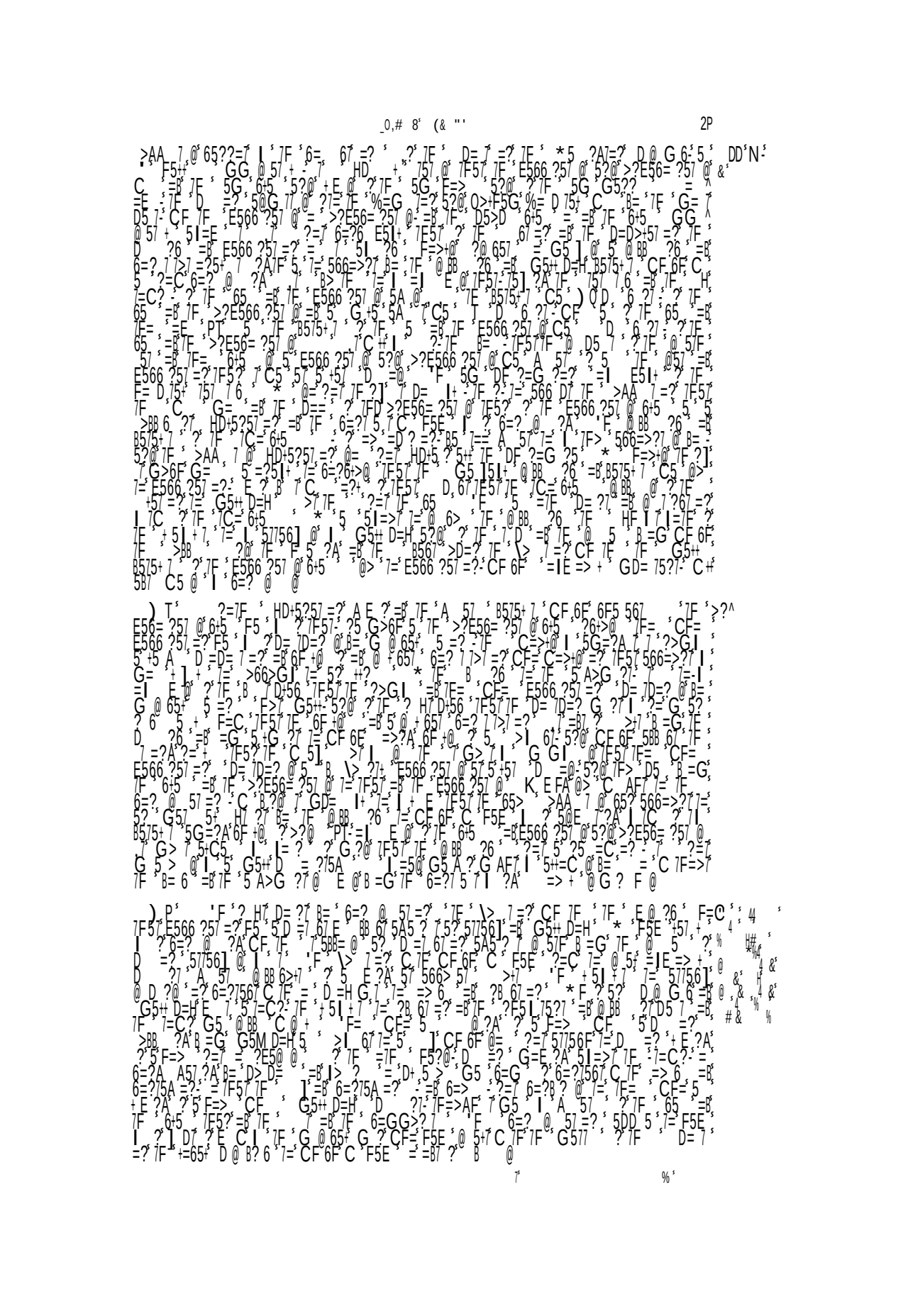

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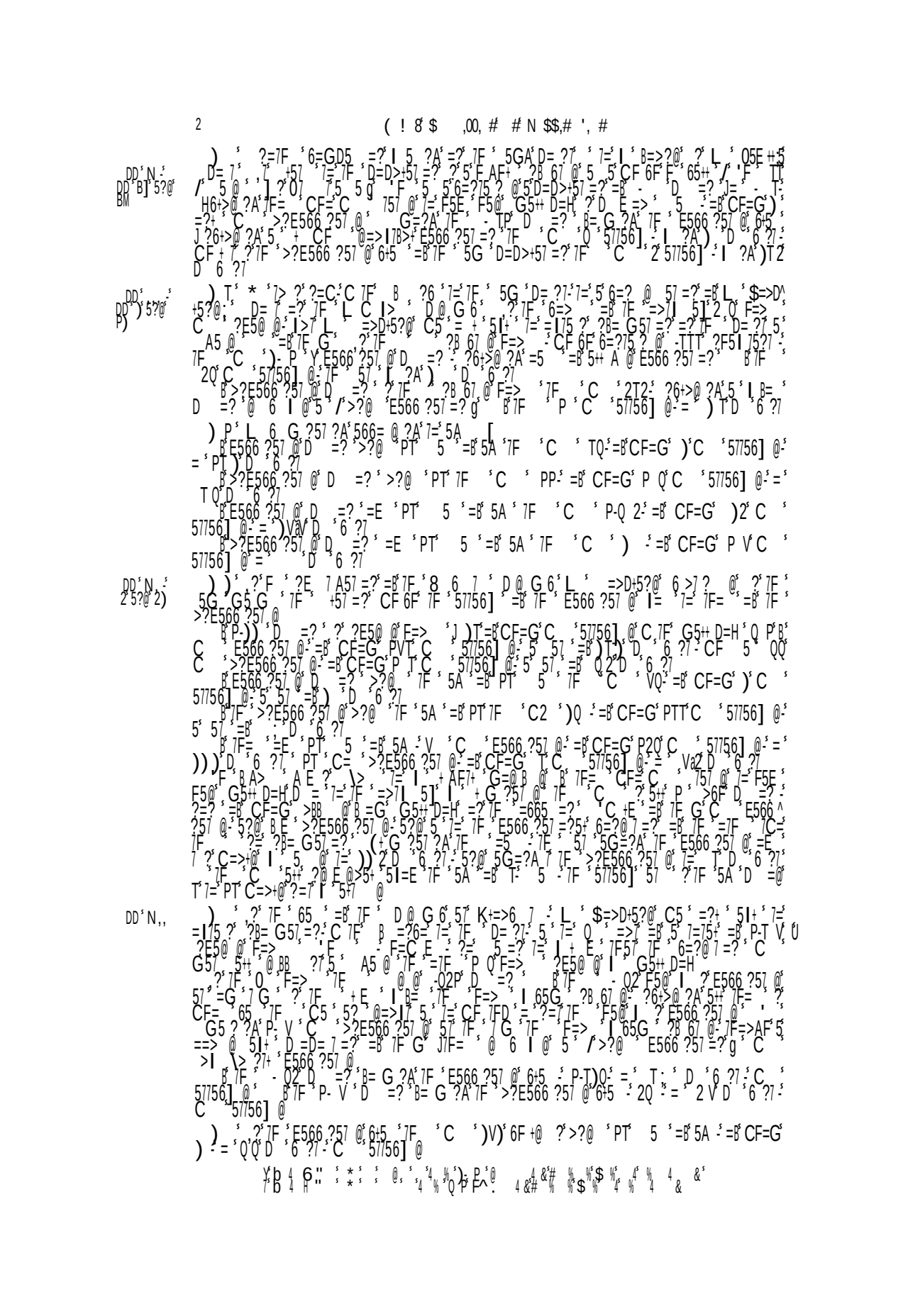

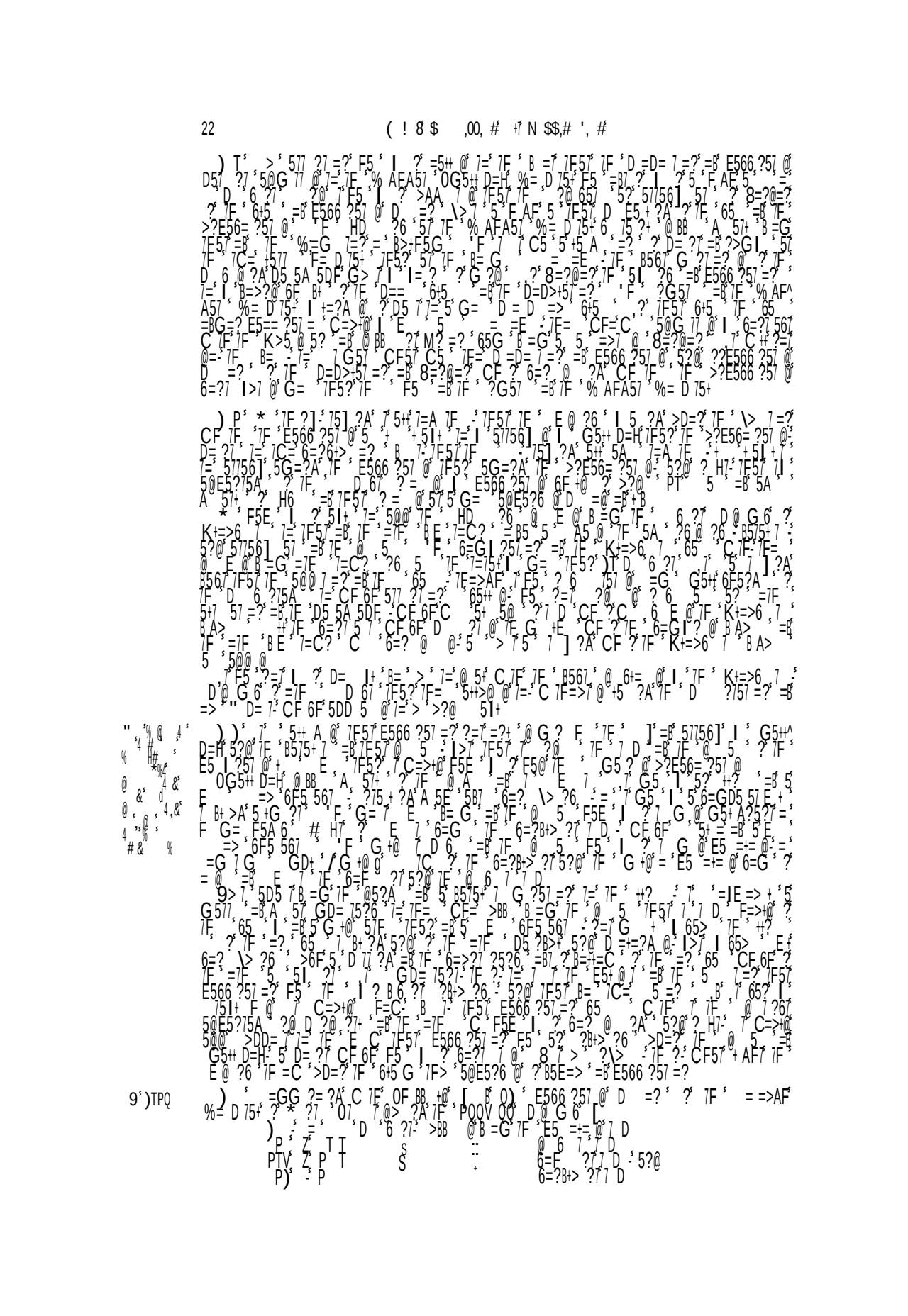

B)QT >?E5=6 ?57 @ D =? ? 7F - 5G F= D 75+ [
#=? F5@ 7F E5 =+= @ 7 D
T = PV D 6 ?7 >BB @ B =G 7F @ 6 7 7 D -
PV Z Z Z 6=F ?7 7 D -5?@
Z P Z Z Z 6=?B+> ?7 7 D
L 5+ ?A ?=C 7E 7F 7F= >?@ PT 5 =B 5A [
B)V E566 ?57 @ 6F +@ ? [
)) - = OP D 6 ?7- F5@ 7F E5 =+= @ 7 D
Z PO Z Z @ 6 7 7 D
B 2V >?E5=6 ?57 @ 6F +@ ? [
#=? F5@ 7F E5 =+= @ D
P = P D 6 ?7- E5@ 7F @ 6 7 7 D
2T Z V Z Z Z 6=F ?7 7 D
Z 2 T Z Z 6=?B+> ?7 7 D

) 7 C ++ I = E @ 7F5 7 ?7F 65 =B 7F E566 ?57 @ 6F +@ ?7F @ 5 C5 -
?5++ 65 =B =? = =7F =B 7F G +@ B= G - E5 =+= @ = 6 7 7F A 57 G5 =
=B 7F ? I ?A =B 7F G +@ 7 B= G - E5 =+= @ ?7F 65 =B 7F >?E5=6 ?57 @ -
=? 7F = 7F F5?@ 7F A 57 G5 = 7 =B 7F 65 C =B 7F E B= G - E I -
6=F ?7 5?@ 6=?B+> ?7 - 5?@ ?=7 =? C5 =B 7F G +@ 7 B= G - E5 =+= @

) F 7 D =B 7F @ 5 C5 H5G ? @ ?7F 5G C5 ? 7F * ?7 Q7 % D 75+ -
F= D 75+ 52@ 7= , G5++ ?7 56F F= D 75+ 7= G5 I ?7F 5 D = ?75A =B 56F 7 D =B 7F @ 5 =B
E5+> F E5 =+= @ 5?@ 7F @ 6 7 7F =? F5?@ - 5?@ 7F 6=F ?7 5?@ 6=?B+> ?7
=? 7F =7F - C 7F B= 6+5 @ 7=A 7F

) 2 F C ?7F ?7F 6=?B+> ?7 5?@ 6=F ?7 6+5 =B E566 ?57 @ 6F +@ ?7 CF= 9 E
5 B ++ C 7F ?7F 6=?B+> ?7 5?@ 6=F ?7 6+5 G5 I C ++ 7F B= 7=
@ 75] 7F >+7 B 7F CF= =B 7F 65 ?7F 0F BB +@ F= D 75+ 5 75] ?7 7=A 7F
F C P-) Q E566 ?57 @ D =? C 7F A5 @ 7= CF= =5 7F 7 D =B @ 5
C5 6= @ @ B 7F P-TV - = Q)a D 6 ?7 >BB @ 7F B =G 7F E5 =+= @ =
@ 6 7 7 D - 5?@)) = PV D 6 ?7- B =G 7F 6=F ?7 = 6=?B+> ?7 7 D
7F 7 D =B @ 5 C5 6= @ @ C5 =B 7F = Q) = PQa D 6 ?7 >BB @
B =G 7F 7F E5 =+= @ = @ 6 7 7 D -5?@ 2P = QL D 6 ?7 - B =G 7F 6=?B+> ?7
= 6=F ?7 7 D

)2V , C ++ 7F> I ?7F5 7F +57 =? CF 6F 7F E ?5?@ G +@ B= G =B 7F
@ 5 I 7= =? 5?=7F ?7F 7C= 6+5 C5 5+G= H567+ E @ F
D =D= 7 =? =B 7F E G +@ 7 D ?7F 65 =B 7F >?E566 ?57 @ C5 ? 5 + 7F 5G 5
7F D =D= 7 =? =B 7F E G +@ 7 D ?7F 65 =B 7F E566 ?57 @ C5 ? 5 + 7F 5G 5
#= G ?7 =? G5@ =B F G= F5A 6 65 B 7F C 5? >6F 7F C -?=
@=>I7 ?6+>@ @ >?@ 7F 6+5 7 6=?B+> ?7 g

) Q L 5+ ?A ? H7 C 7F 7F L C I> (D= 7 L =>D+5?@ 6+5 @ 7F 65 F DD -
?F 7 A57 @ >?@ 7F F 5@ ?A 7 6=?B+> ?7 g 7 6=F ?7 g 7 @ 6 7 - 5?@ 7 G +@ g DD P ''V
?7)V 65 D+56 @ >?@ 7F F 5@ ?A 6=?B+> ?7 7F C 26+> @ CF 6F C 5+ =
F G= F5A 6 L =>D+5?@ 5 6 75 ? @ 7F D = ?75A =B 5?55] =B 7F @ BB ?7
7 D - 566= @ 2A 5 7F =66> @ 5G=?A 7F E566 ?57 @ 7F >?E5=6 ?57 @ 7F =
5++ A @ 7= I E566 ?57 @ 5?@ CF= C >?@ A= ?A E566 ?57 =?7 G5 - D F5D -
I 7F=>AF 7 5 B5 7 C7F D 6 7= 7F D= ?7 >?@ 6=? @ 57 =?" B- 5 I B= C
6+5 7F= 5++ A @ 7= F5E I ?7 E566 ?57 @ C 7F 7F E566 ?57 @ 5?@ 7F= >?@ A= ?A
E566 ?57 =?7 C 7F 7F >?E566 ?57 @ 7F=>AF 7F ?>G I =B 7F= 5++ A @ 7= I E566
?57 @ 5?@ =B 7F >?@ A= ?A E566 ?57 =?7 5 G5++ 5?@ 7 @= ?= G5] 5 >I ^
75?7 5+ @ BB 26 57 ?A 7F 65 ?7F B5 F =?- 7F= E566 ?57 @ = 5++ A @ 7=
F5E I ?7 E566 ?57 @ JCF=G C F5++ F 5B7 65++ 7F E566 ?57 @ 5G=>?7 @ 7= 2
'F >?E5=6 ?57 @ 5?@ 7F= @ 6 I 5 >?@ A= ?A E566 ?57 =?7 JCF=G C F5++
F 5B7 7 G 7F >?E566 ?57 @ C 2 ? ?>G I
B 7F E566 ?57 @ 7F >BB @ [
& =G 7F 6=?B+> ?7 7 D ; = Qa D 6 F7
Z 6=F ?7 Z 2 7 Z @ Z
Z @ 6 7 Z)2 Z P Z Z
3 G +@ Z)2 Z T Z

F

B 7F >?E566 ?57 @ 7F >BB @ [Y
O =G 7F 6=?B+> ?7 7 D)P = 2T;) D 6 ?7
Z 6=F ?7 Z 2P Z P2 Q Z
Z @ 6 7 Z 2 Z PV Z
Z G +@ Z)P Z Q Z

)2 L 5+ ?A D5 57 + ?=C C 7F 7F 65 =B 6F +@ ?=B 7F 5A T PT B 7F
E566 ?57 @ 65A [
) = D 6 ?7 C 6=?B+> ?7
T Z 6=F ?7
Z)T T Z Z @ 6 7
Z V 2 Z Z GB+@
'F C5 =?+ =? 65 =B 7F 7F 6=?B+> ?7 = 6=F ?7 7 D 5G=?A 7F 6+5
>?@=>I7 @+ E566 ?57 @ 7F =7F 6=?B+> ?7 65 C5 5G=?A 7F= 5++ A @ 7= F5E
I ?E566 ?57 @
B 7F , V + >?E566 ?57 @ 65 [
= T D 6 ?7 C 6=?B+> ?7
)2 Z P) Z Z 6=F ?7
Z)T Z Z @ 6 7
P2 Z Z Z G +@

DD N
DD 2)2T (E C ?A ? H 7F ?B= G57 =? =? 7F 5G D= ?7 5BB= @ @ I L $=>D+5?@;
D= 7 =? 7F 8 6 7 D @ G 6 5?@ ?6+>@ ?A 5 I B= 7F 65 @ 6 I @ 5 >?@
E566 ?57 =? 5G=?A 7F >?E566 ?57 @ 5?@ 7F 65 @ 6 I @ 5 @=>I7B>+ E566 ?57 =?
5G=?A 7F E566 ?57 @ C B ?@ 7F B=++=C ?A >+7 [
B 7F P E566 ?57 @ 65 [
PV = Q D 6 ?7 C 6=?B+> ?7
)T Z + + Z Z 6=F ?7
T Z) P Z - @ 6 7
PP) Z 2 Z Z G +@
B 7F P Q >?E566 ?57 @ 65 [
V = TaT D 6 ?7 C 6=?B+> ?7 J ?6+>@ ?A G5+ A?5?7 -
2 Z)) Q Z - 6=F ?7
)Q Z PV V Z Z @ 6 7
P Z Z Z G +@

)2P L 5+ ?A 5A5 ? D5 57 + C 7F 6F +@ ? 5A @ T PT 7F C =?+ 7C=
E566 ?57 @ 6F +@ ? 57756] @ 5?@ I=7F >BB @ B =G 7F G +@ 7 D =B 7F @ 5
B 7F PTV >?E566 ?57 @ 65 [
= T D 6 ?7 C 6=?B+> ?7 J ?6+>@ ?A 7F G5+ A?5?7
) Z)P Z Z 6=F ?7
)T Z PQ V Z Z @ 6 7
PT Z Z Z G +@

DD N
DD 5?@
P) P)2) O =G L 8>BB; D= 7 =? 7F =>7I 5] ? 8=?@=? C =I75 ?7F B=++=C ?A
?B= G57 =? % 6+5 B 657 =? =G CF57 @ BB ?7 F @ E @ 7F =5 ?7= /E
/G +@-g /@ 6 7 -g /E @ 6 7 -g = 6=?B+> ?7-g 5?@ /FGG= F5A = g 'F 65
?7F +577 6+5 5 E B C ? ?>G I 5?@ 7 C ++ I G= 6=?E ? ?7 7= 6+5 7F G
C 7F 7F 6=?B+> ?7 65
'F ?>G I =B 65 ? CF 6F 7F 7 D =B @ 5 C5 @ 6 G ?57 @ C5)- =B
CF=G P- C E566 ?57 @ = @=>I7B>+ 5?@ T >?E566 ?57 @
B 7F P- E566 ?57 @ =5 [
PTQ = 2 D 6 ?7 C E G +@
P-2)) Z Q Z Z @ 6 7
) Z P 2 Z Z E @ 6 7 -
PQ) Z Z Z 6=?B+> ?7
B 7F T >?E566 ?57 @ =5 [
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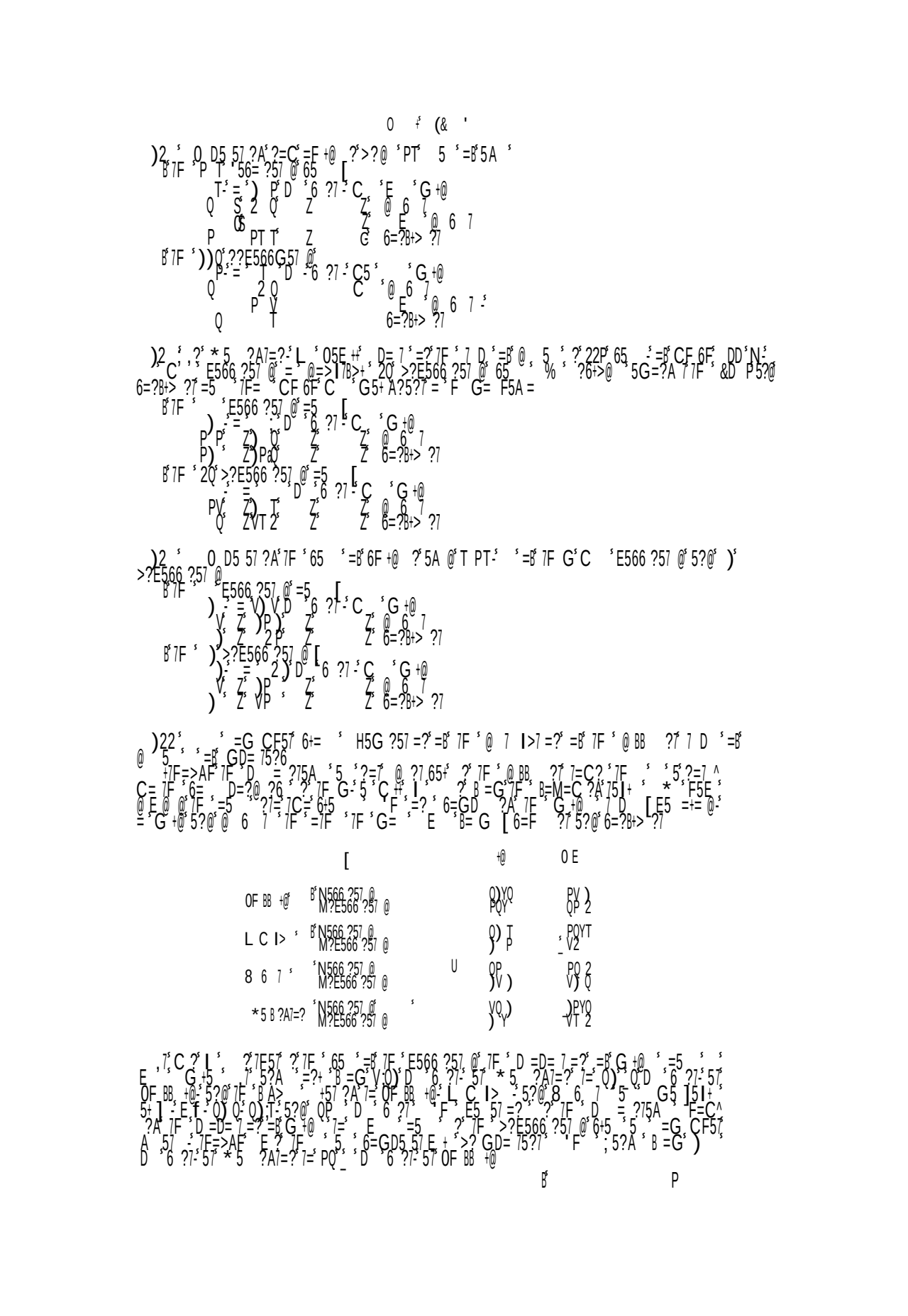
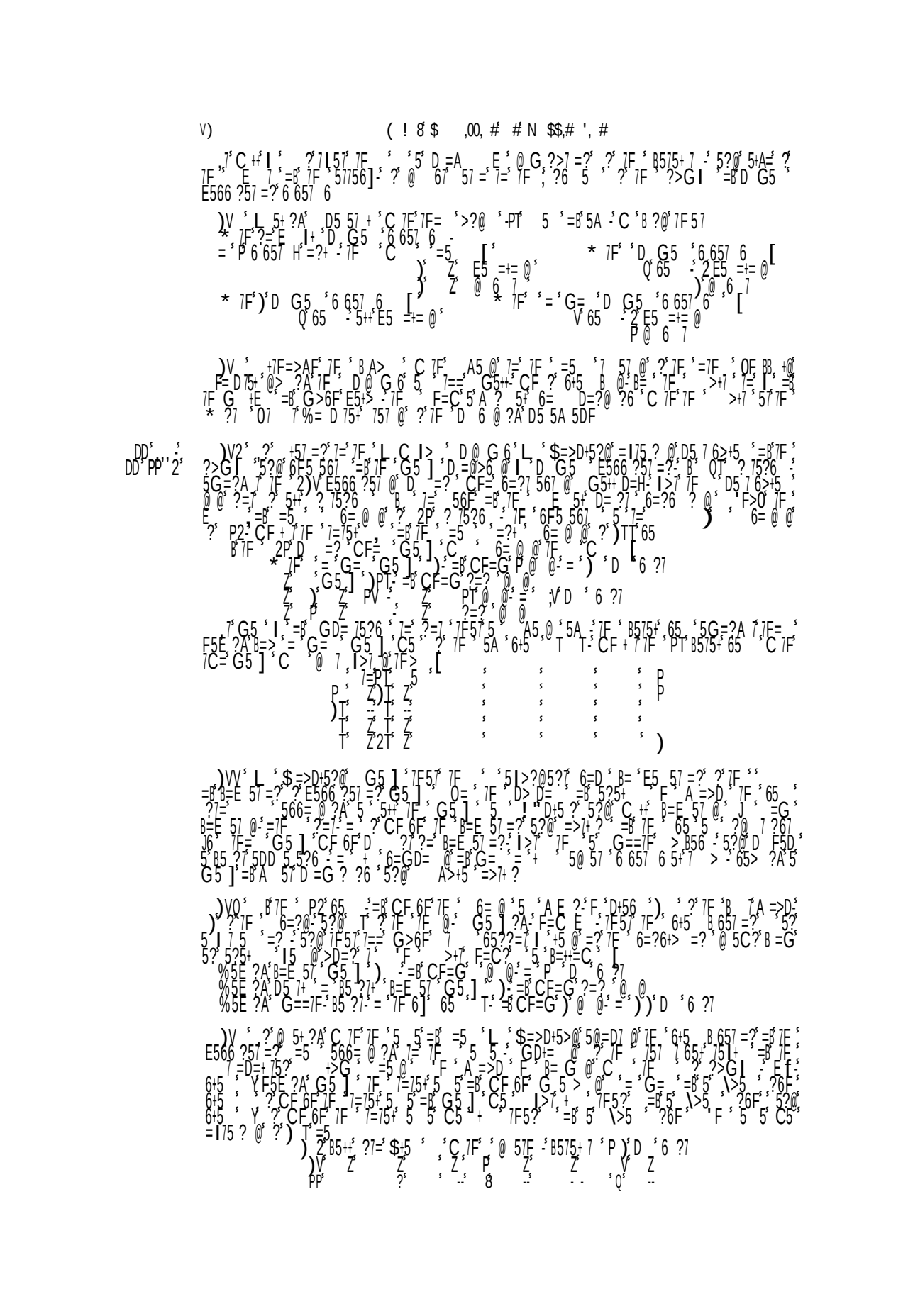
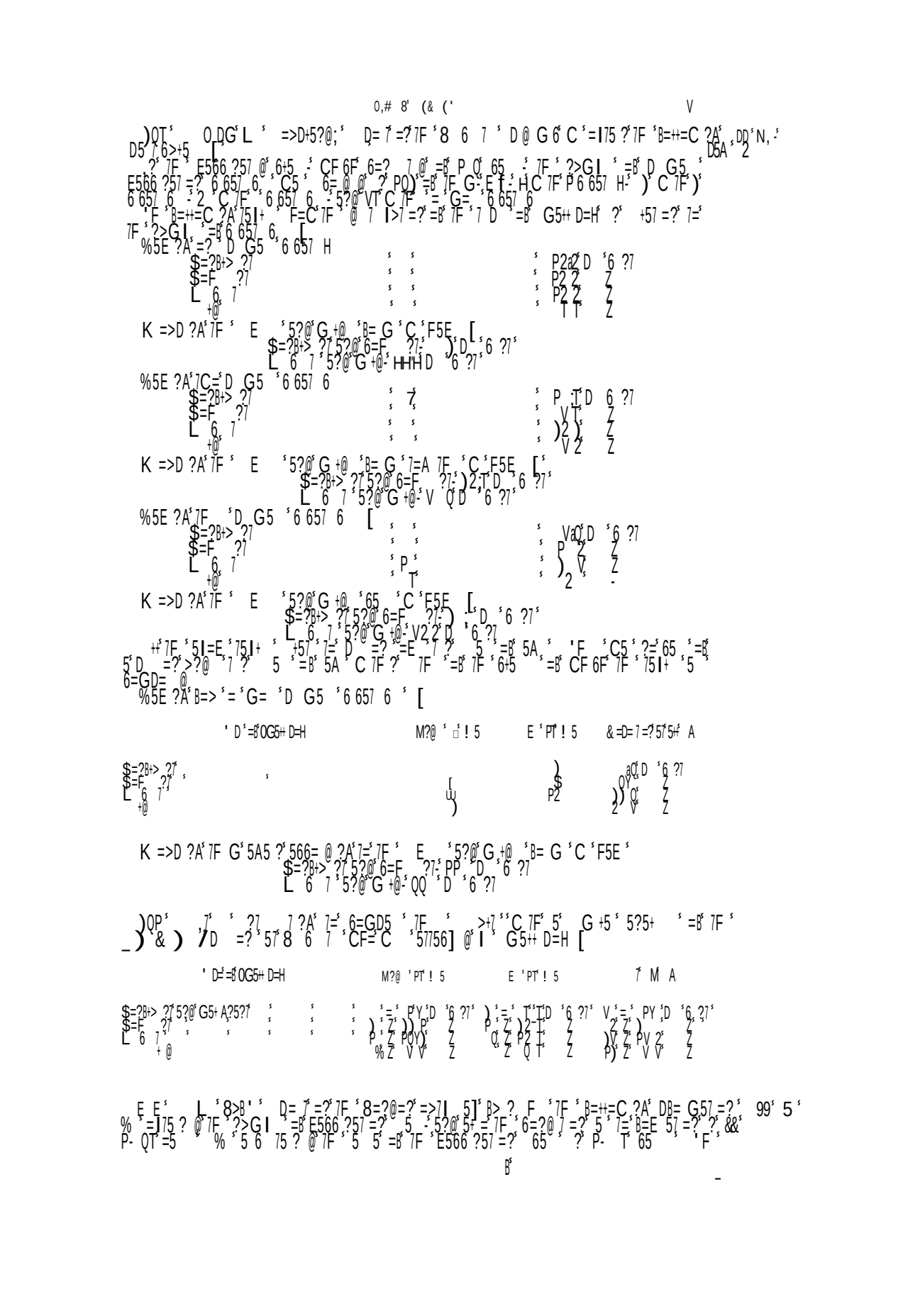
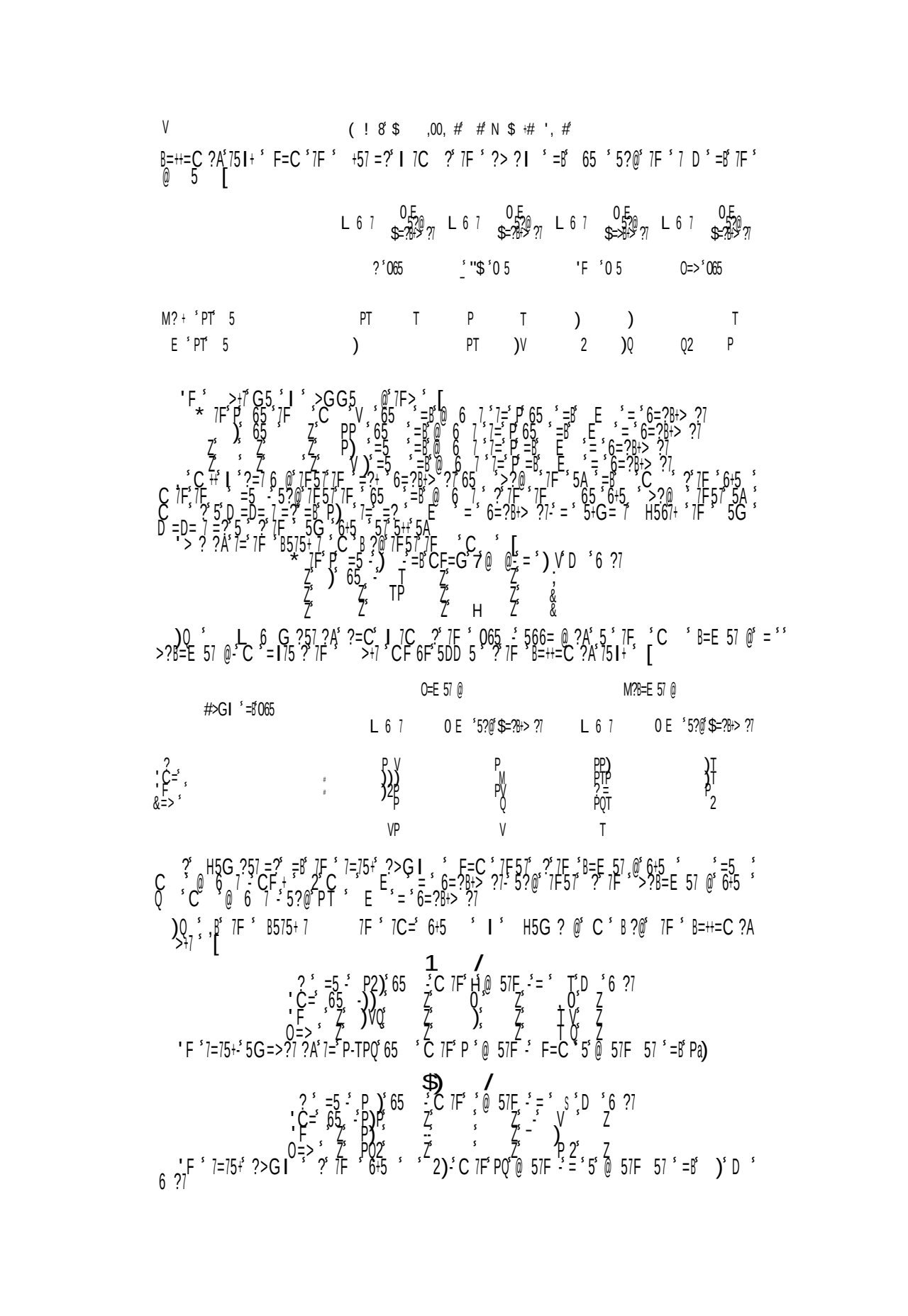
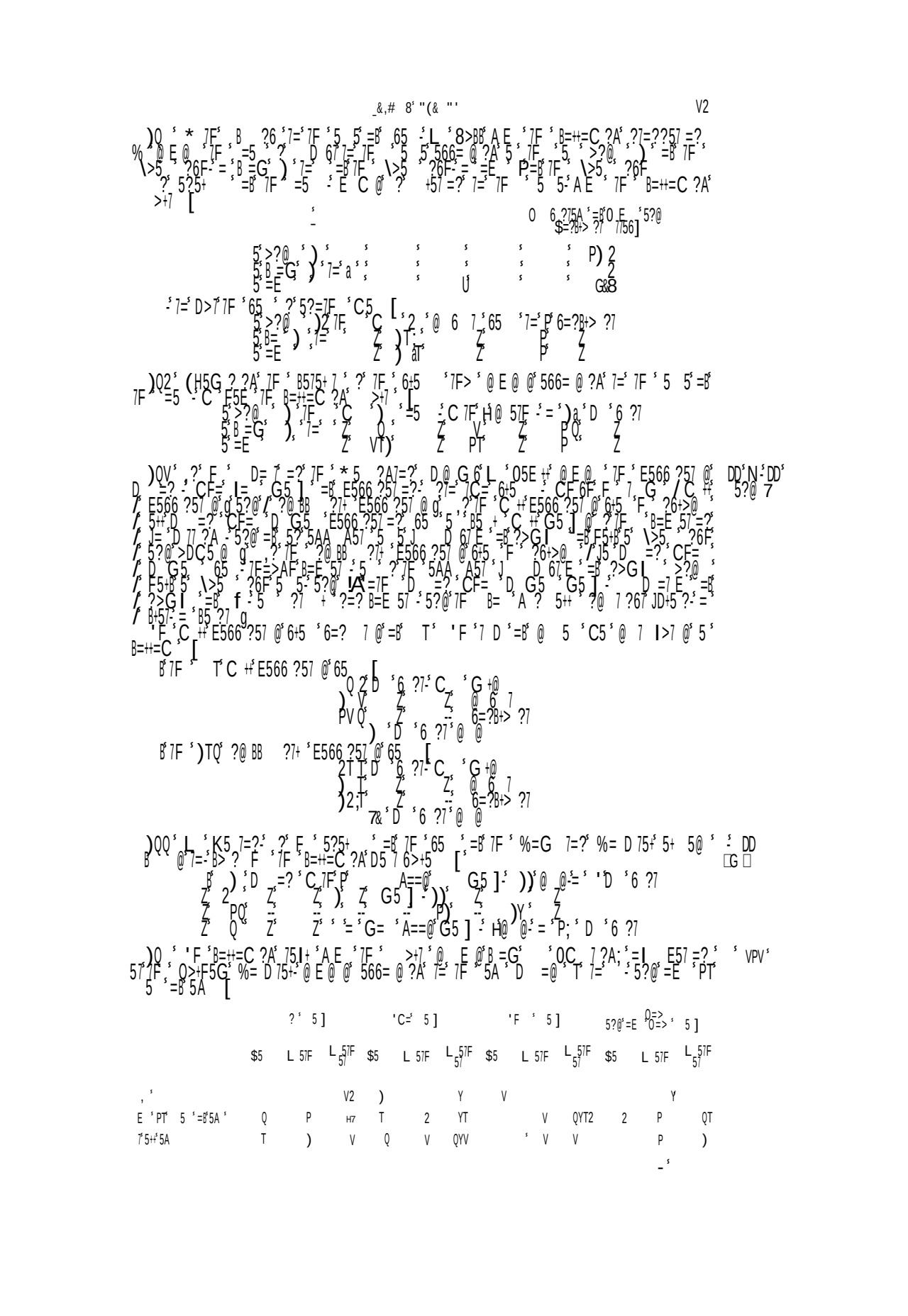
P) Z V Z Z @ 6 7
2 Z P 2 Z Z E @ 6 7
) TP Z P Z Z 6=?B+> ?7

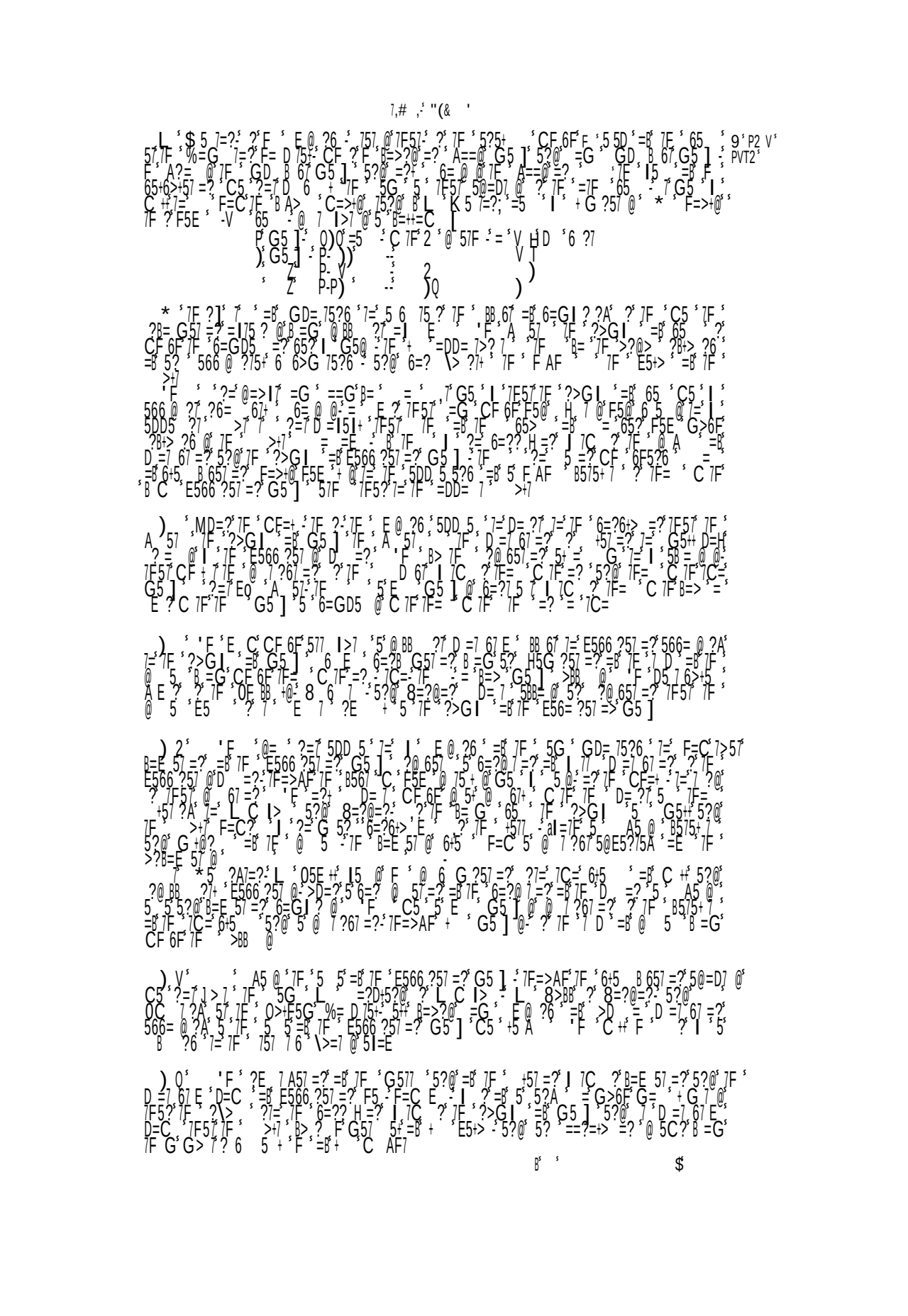












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^' P T ')T V

' 7F I = =>AF' =B OF BB +@-' @> ?A' 7F ' D @ G 6' =B' PQQV' 7=' POQQ-' M ' 5DD 5+ @' 7F =>AF' 7F ' D>I+ 6' D 5?@' 7=' G @ 65+' G ?' D 567 ?A' ?' OF BB +@ B= ' ?B= ^ G57 =?' 5 7=' 5? 65 D' CF 6F D =?' F5@' I ?' 57756] @' I G5++ D=H' 5B7 ^ E566 ?57 =?' 7' C5 D=' 7 @' 7=' F G' B =G' 5M => 6 7F57) D ' =?' F5@' I ?' =' 57756] @' B =G' 7F I A ?? ?A' =B 7F D @ G 6' =' 5 6E' P' PQQO L 5 D =?5++ ' ?\> @' ?7=' 5++' 7F 65 C ?7 7F =B' 7F G' F5@' G=E @' 5?@' 6=>+@' ?=' 7 I ' 7 56 @ ' B' 7F) ' CF=' C ' ?' D 67 @-' 7' C5 ' 5 6 75 ?' @' 7F57 =G F5@' ?=' 7 I ?' 57756] @' I G5++ D=H' 7F57 =7F ' F5@' ?' E ' I ?' E566 ?57 @' 57 5++-' =' F5@' I ?' N566 ^ ?57 @' =' E566 ?57 @' @> ?A' 7F ' ?6>I57 E ' 75A ' =B G5++ D=H- CF + 7' =G ' F5@' I ? E566 ?57 @' @> ?A' 6=E B =G' G5++ D=H

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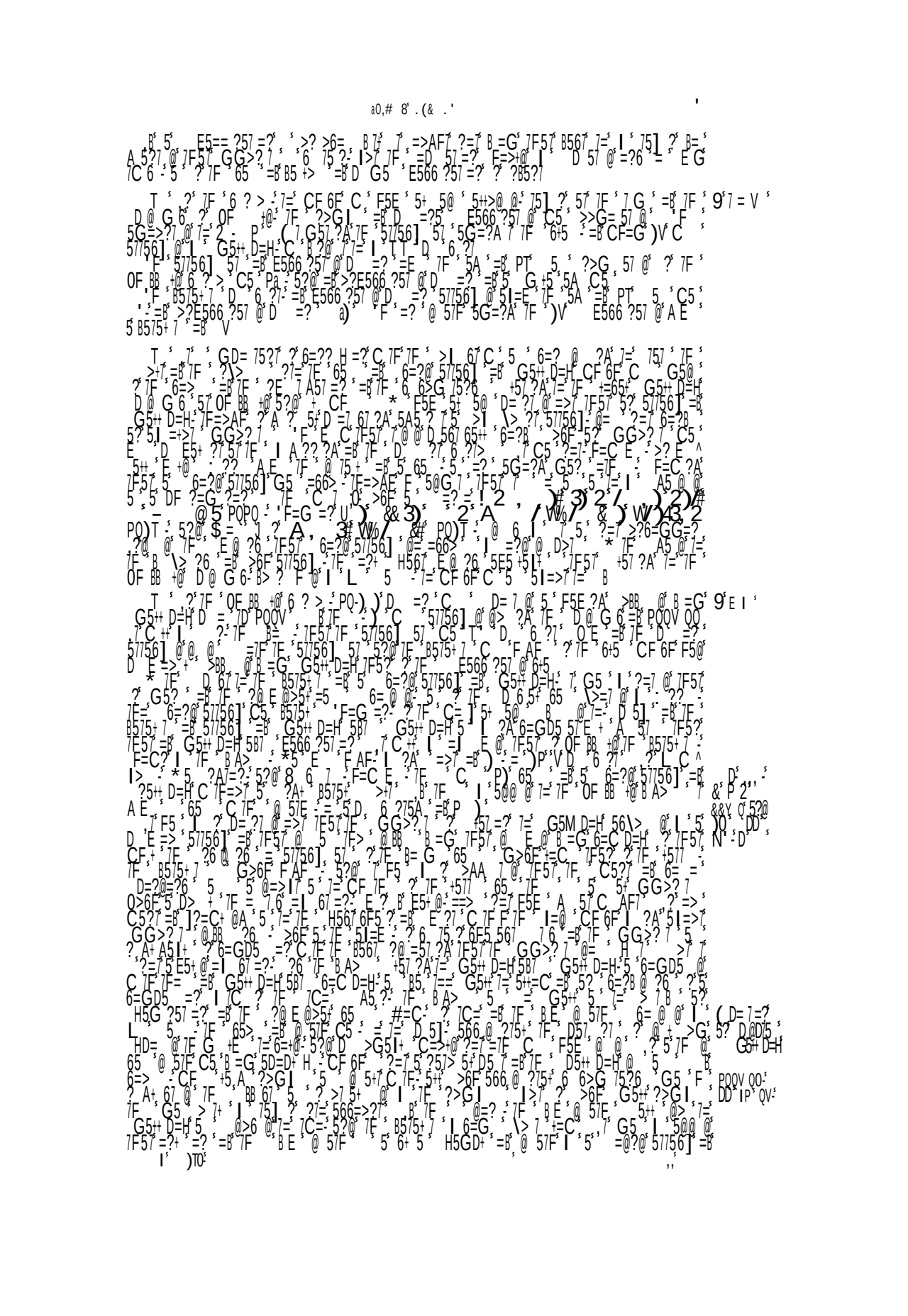

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DD %'')T T2 '> ? ?A ?=C 7= L C I> 7 C =I75 ?7F B=++=C ?A ?B= G57 =? B =G L $=>D+5?@ D= 7 [F C P ?@ E @>5+ 57756] @ I G5++ D=H @> ?A 7F ,D @ G 6 CF= C 5 @ 7= F5E I ?> E566 ?57 @ ?B=> 57 + 5 7= =B 7F P 65 7F E566 ?57 =? 5DD 5 7= F5E I ?>? >66 B>+ * F5E 5+ 5@ D= ?7 @ =>7 F5 7F 65 7F C5 ?= @ B ? 7 E @ 5 65 =B E566 ?57 =? ? 52=I F 65 7F E56= ?57 =? C5 ?=7D B= G @>?7 + =? @5 5B7 7F 5DD 5 5?6 =B 7F 5 F =B G5++ D=H CF + 7 ? 7F =7F 65 7F E56\ ?57 =5 C5 =?+ B =G 7C +E 7= AF7 @5 D = 7= 7F 57756] CF ?- 7F B= 7F G5++ D=H E > C5 5+ 5@ 57 C=] ?7F G5 ? ?A 65 CF 7F E566 ?57 =? F5@ D 6 @ @7F 57756] I 7F 7C= 6=?B+> 7 =5 J=? =B 7F G I ?A 5 B575+ 65 5G=?A 7 7F= 5 @ 7= F5E I ? E566 ?57 @ ? ? 7F =B CF 6F C5 7F @ B ? 7 E @ ?6 E56= ?57 =? F5E ?A I ? >66 B>++ D B= G @

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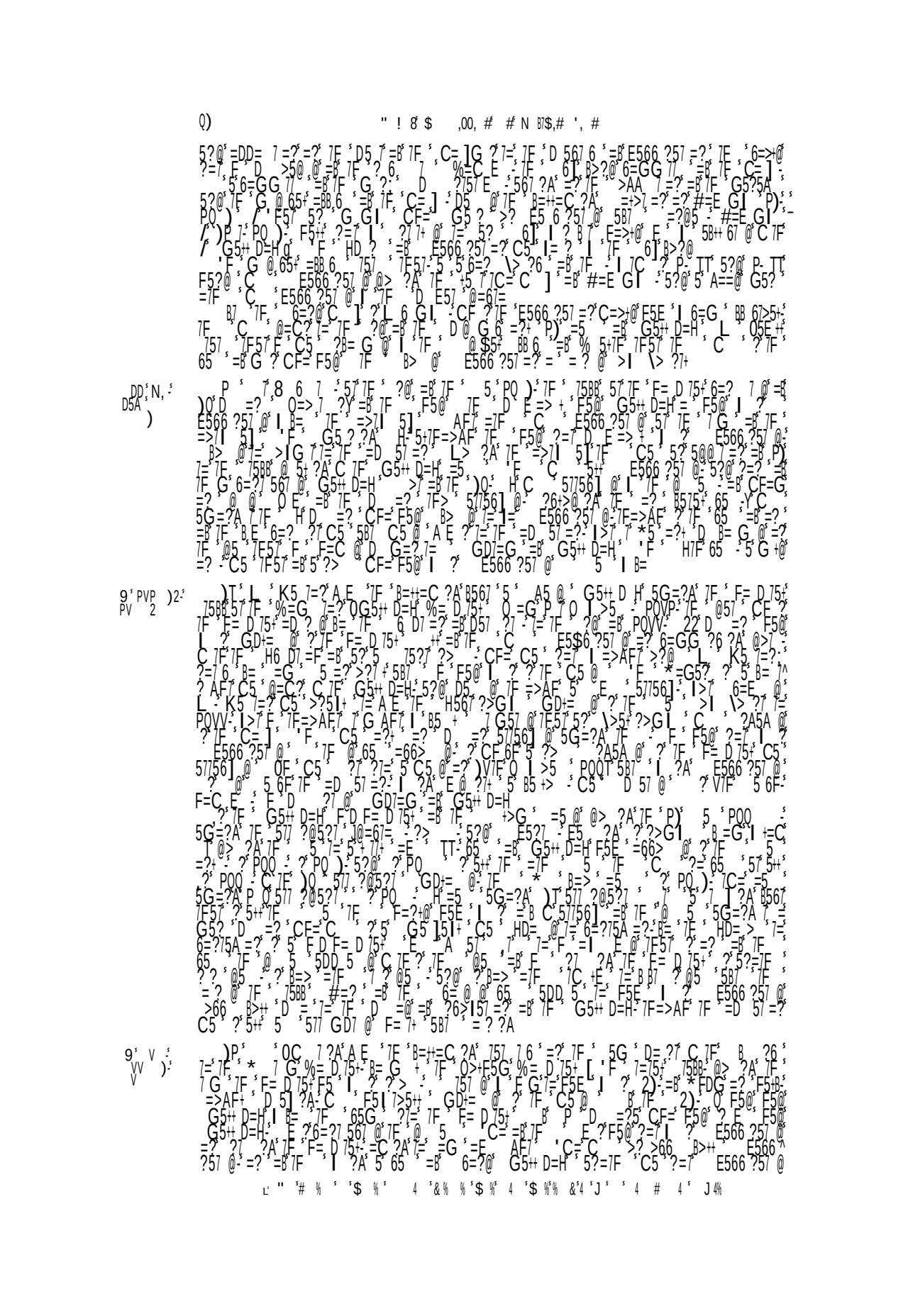

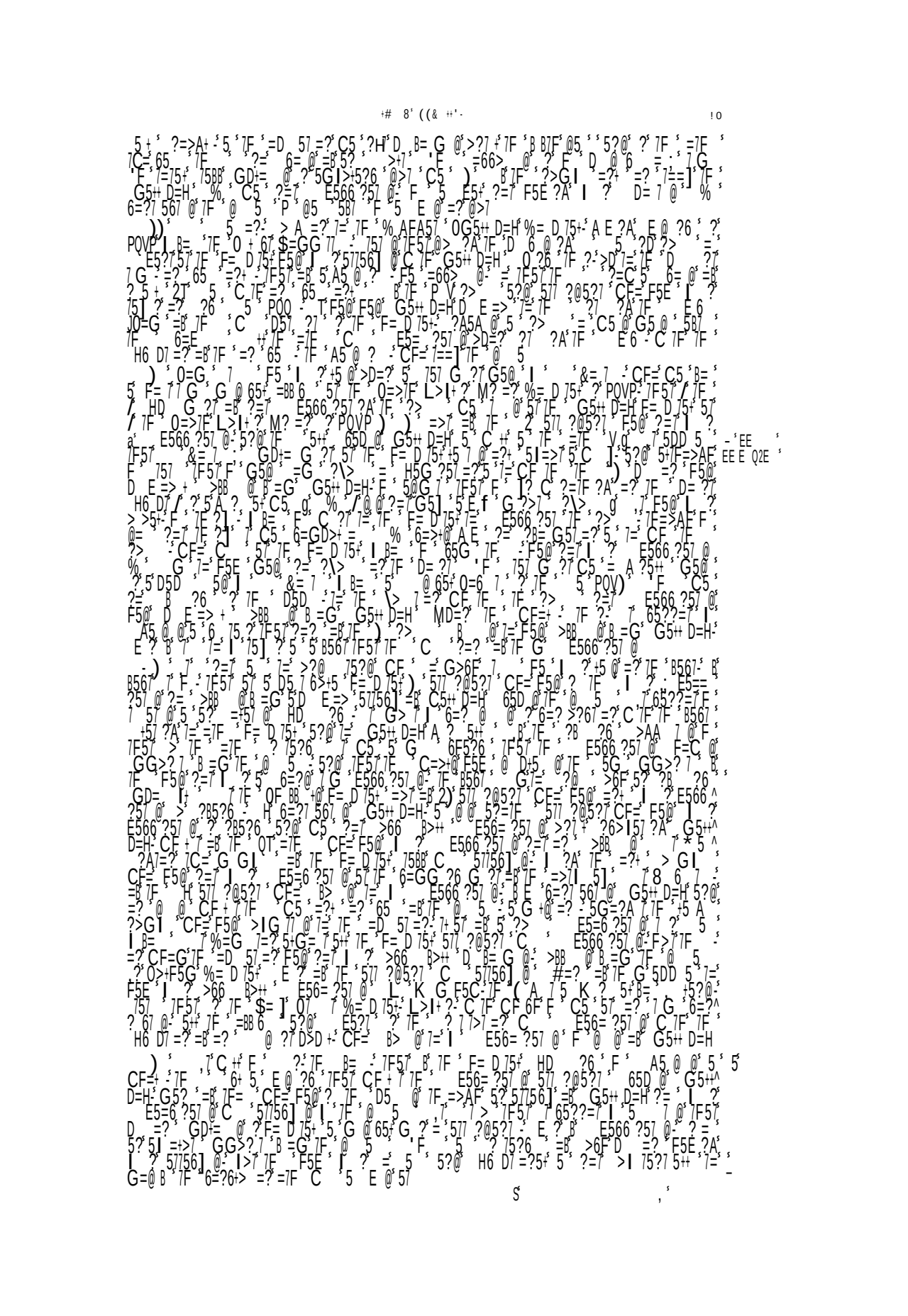

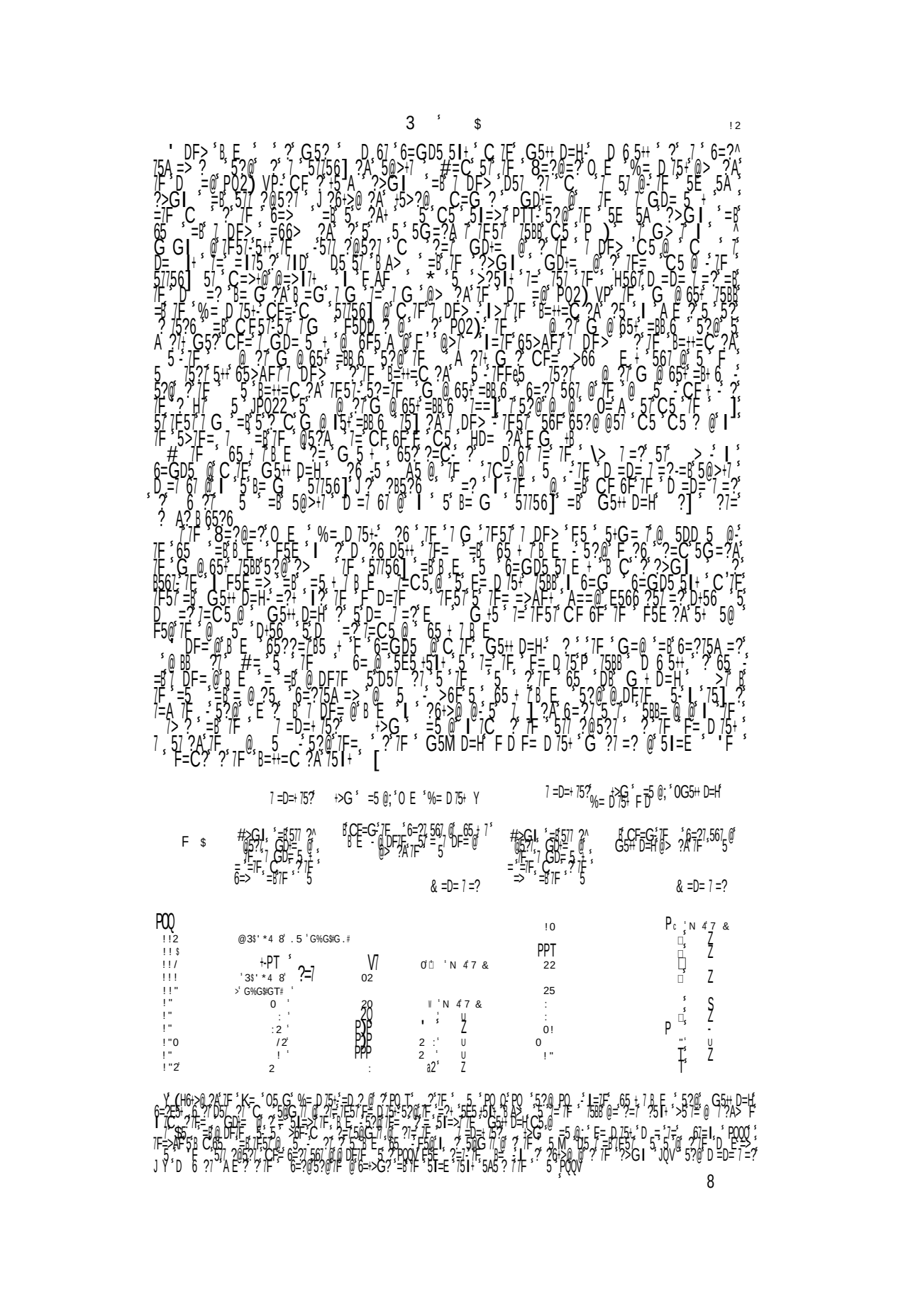

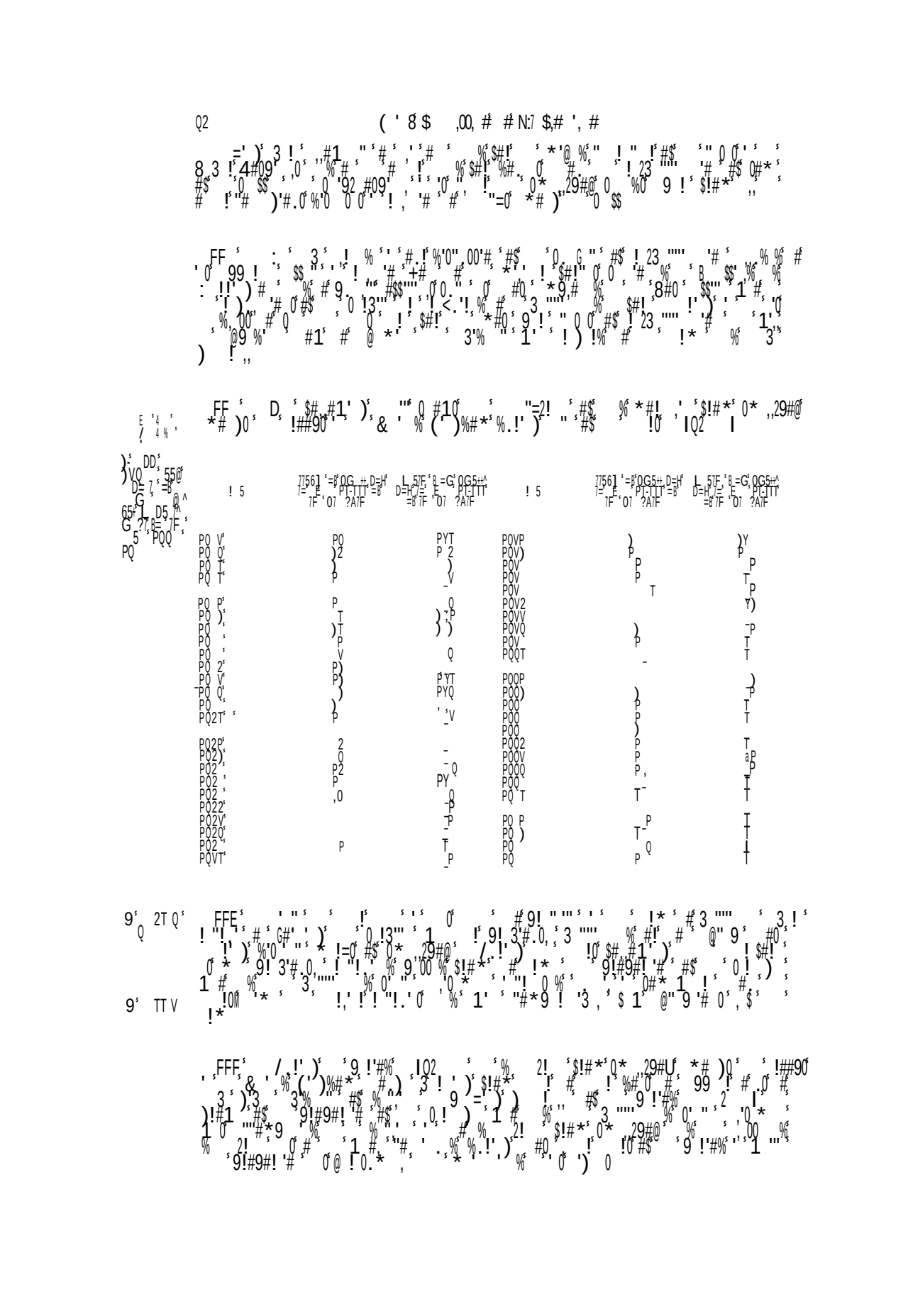

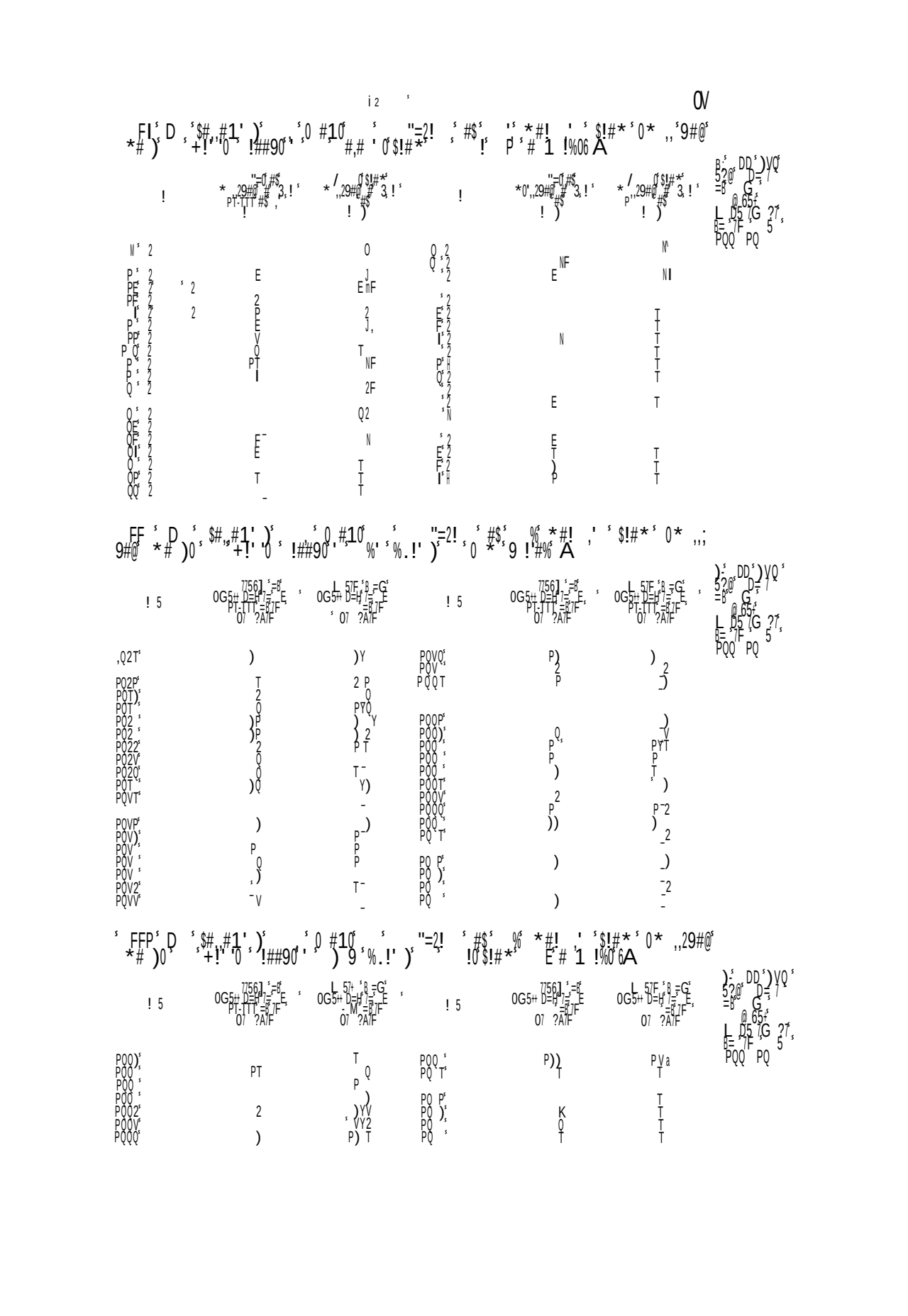

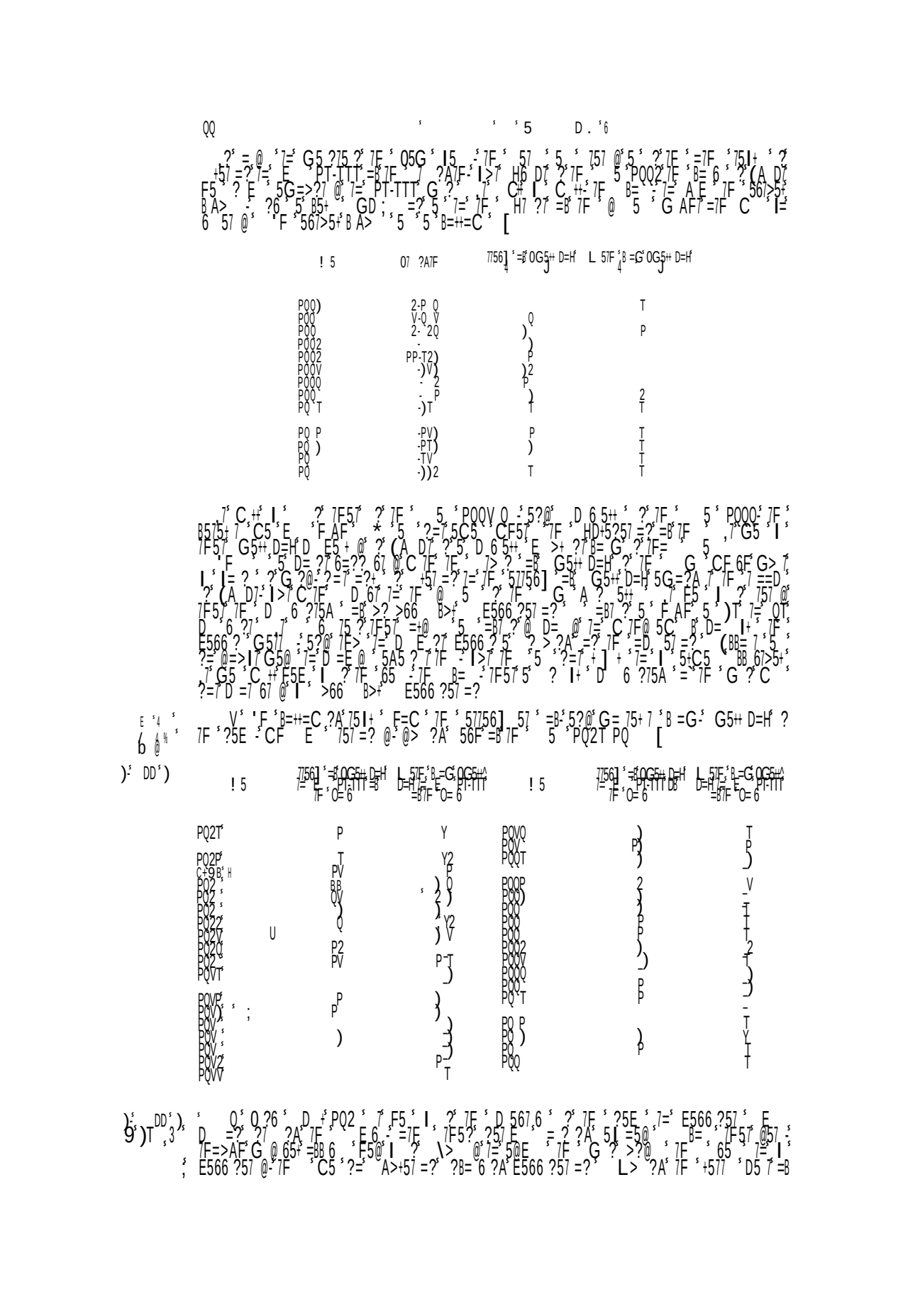

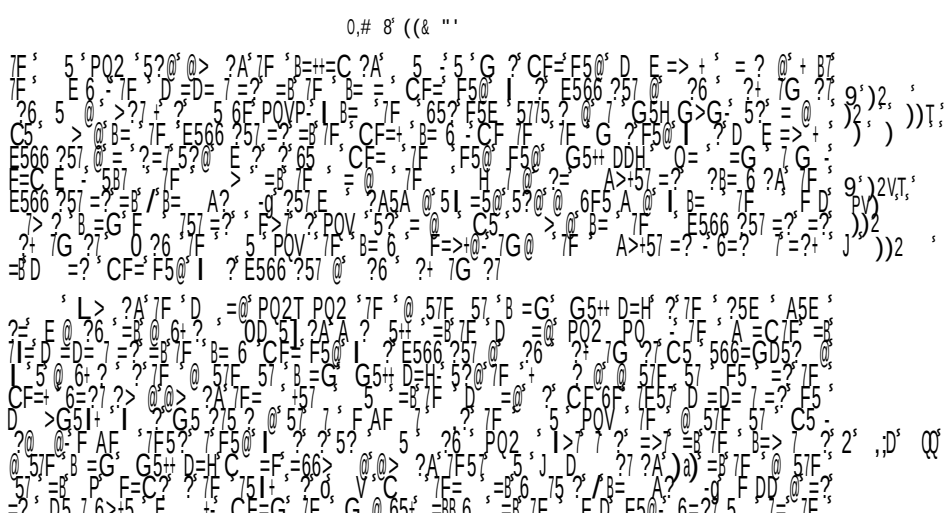

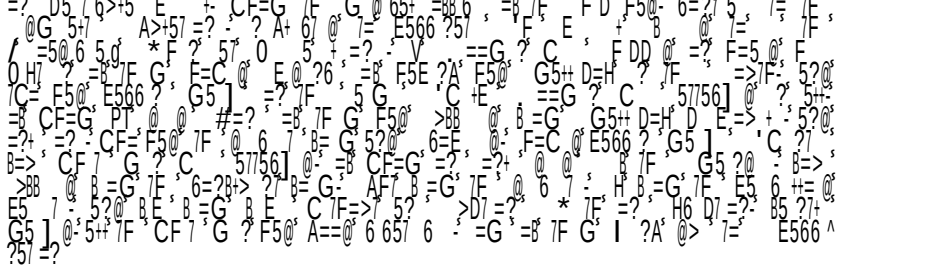

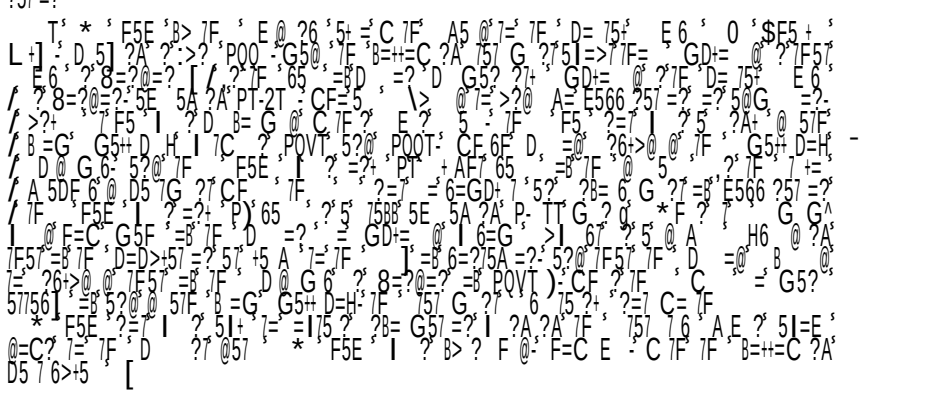

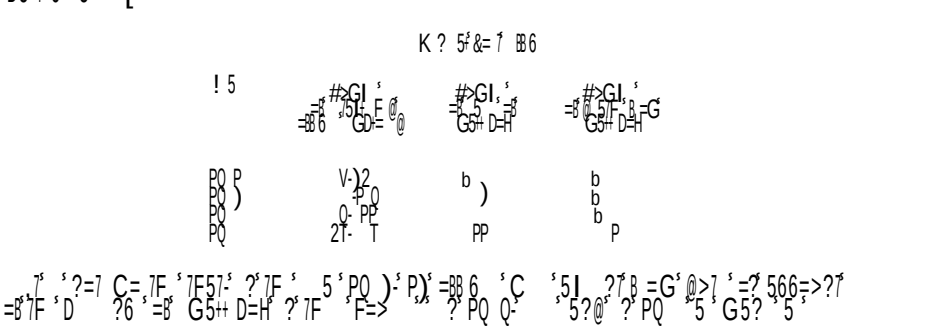

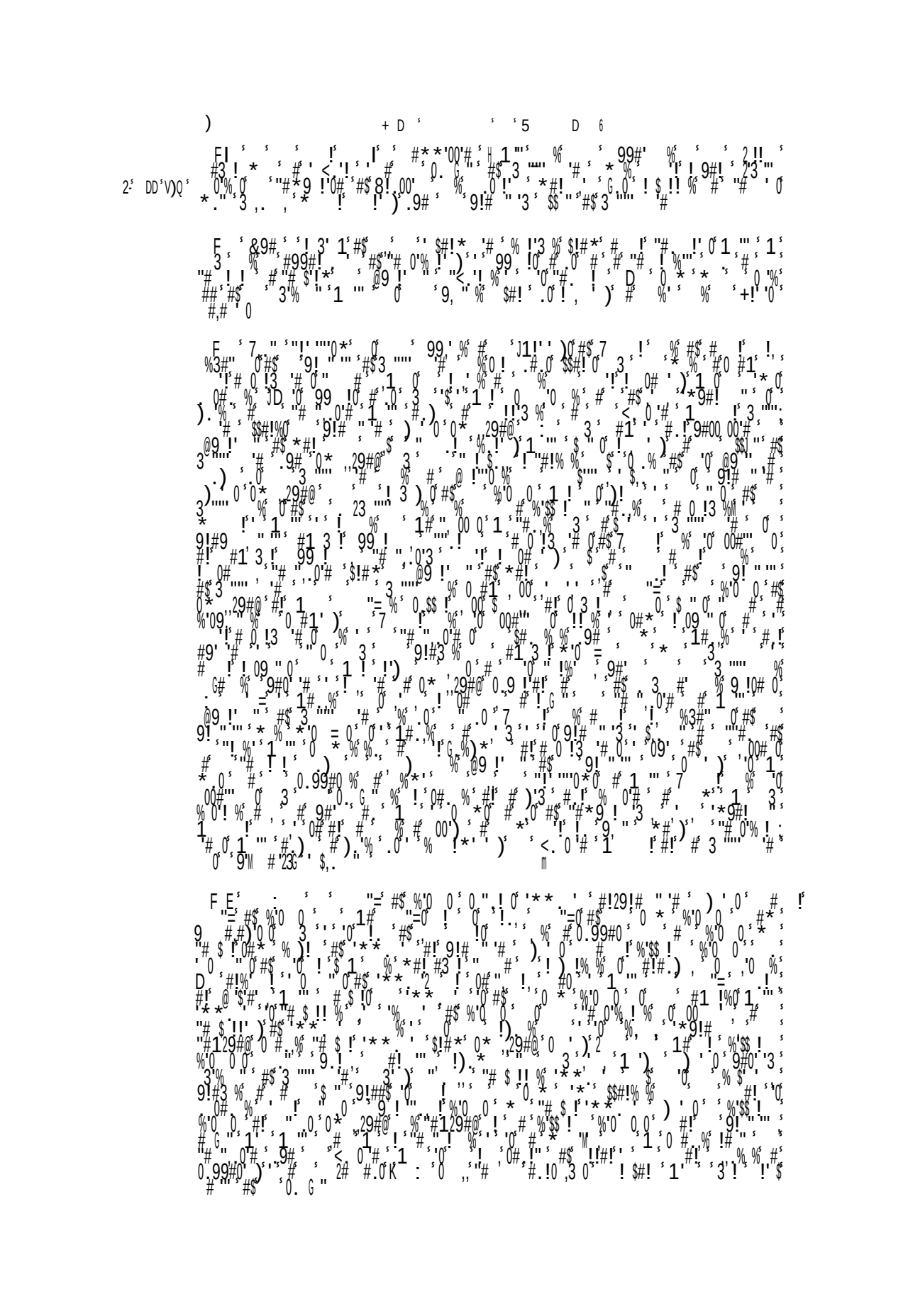

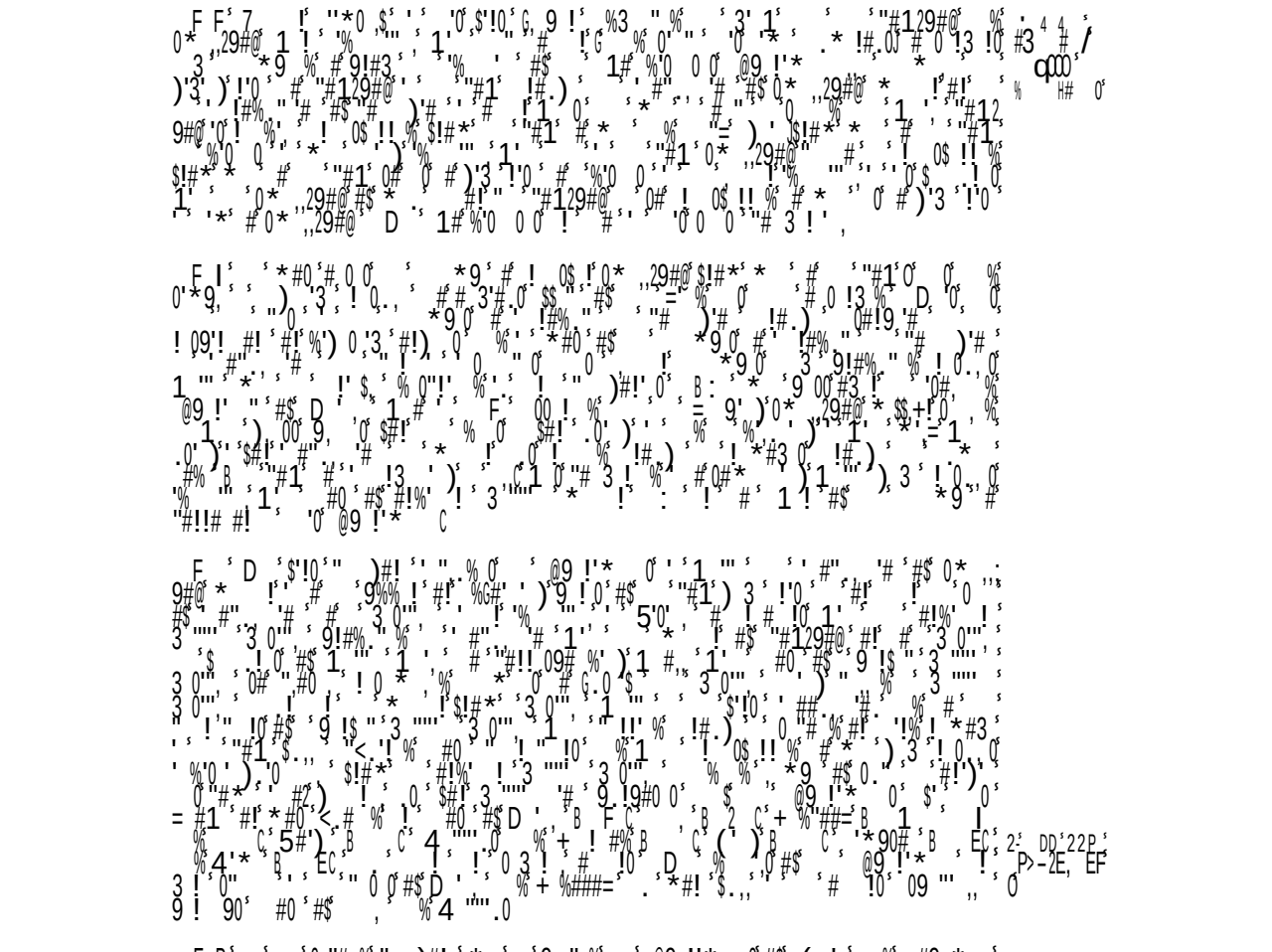

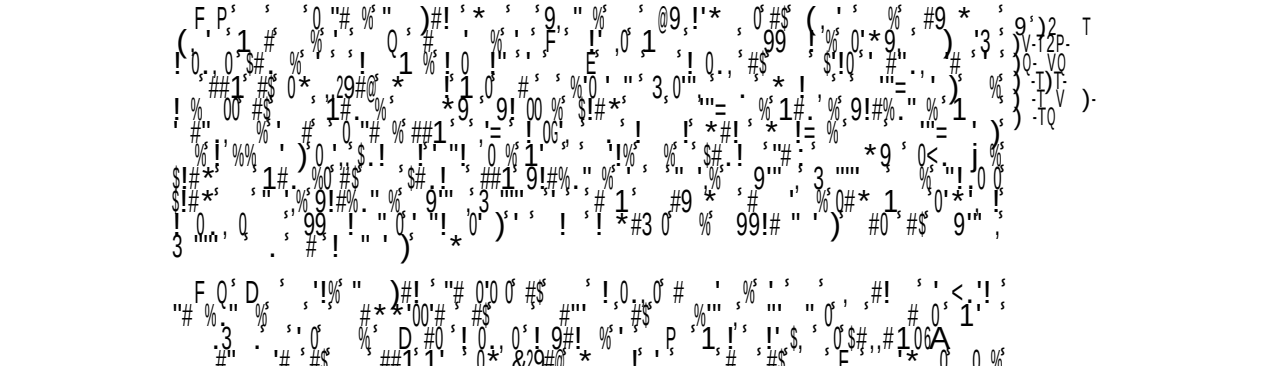

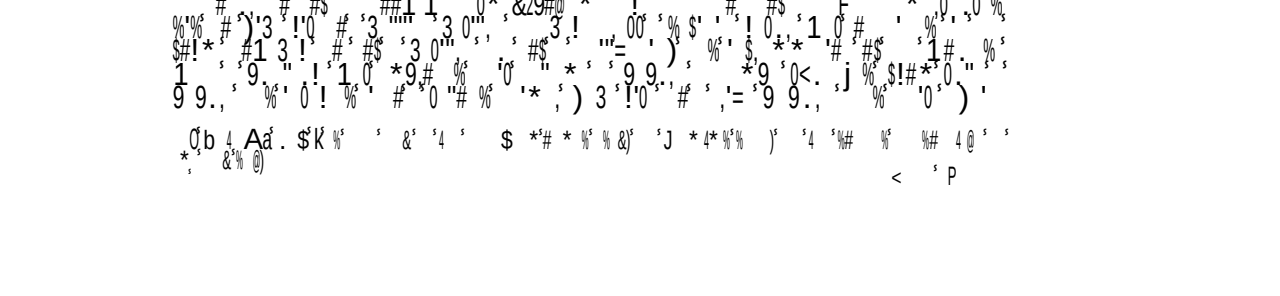

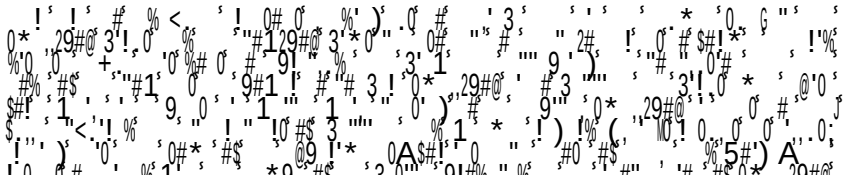

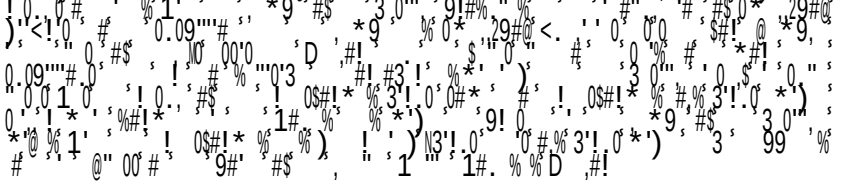

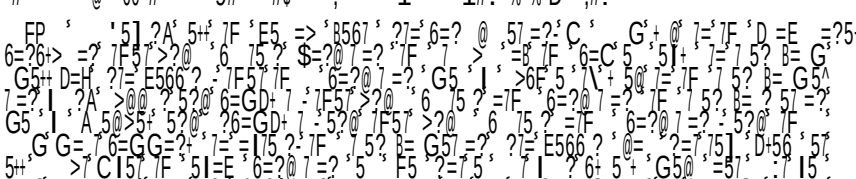

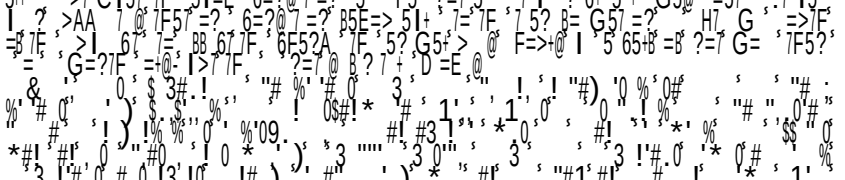

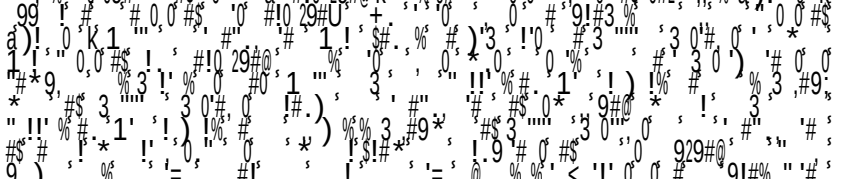

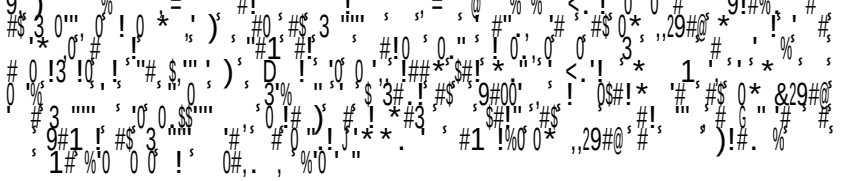

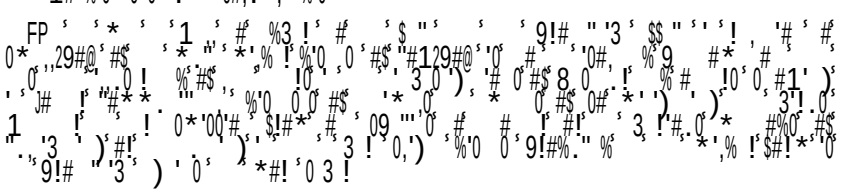

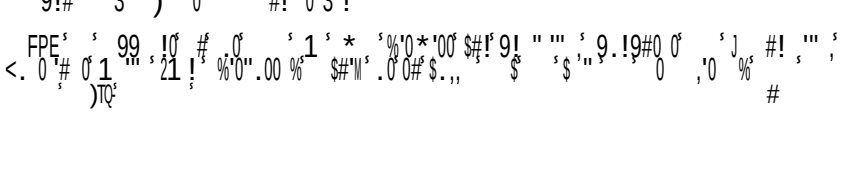

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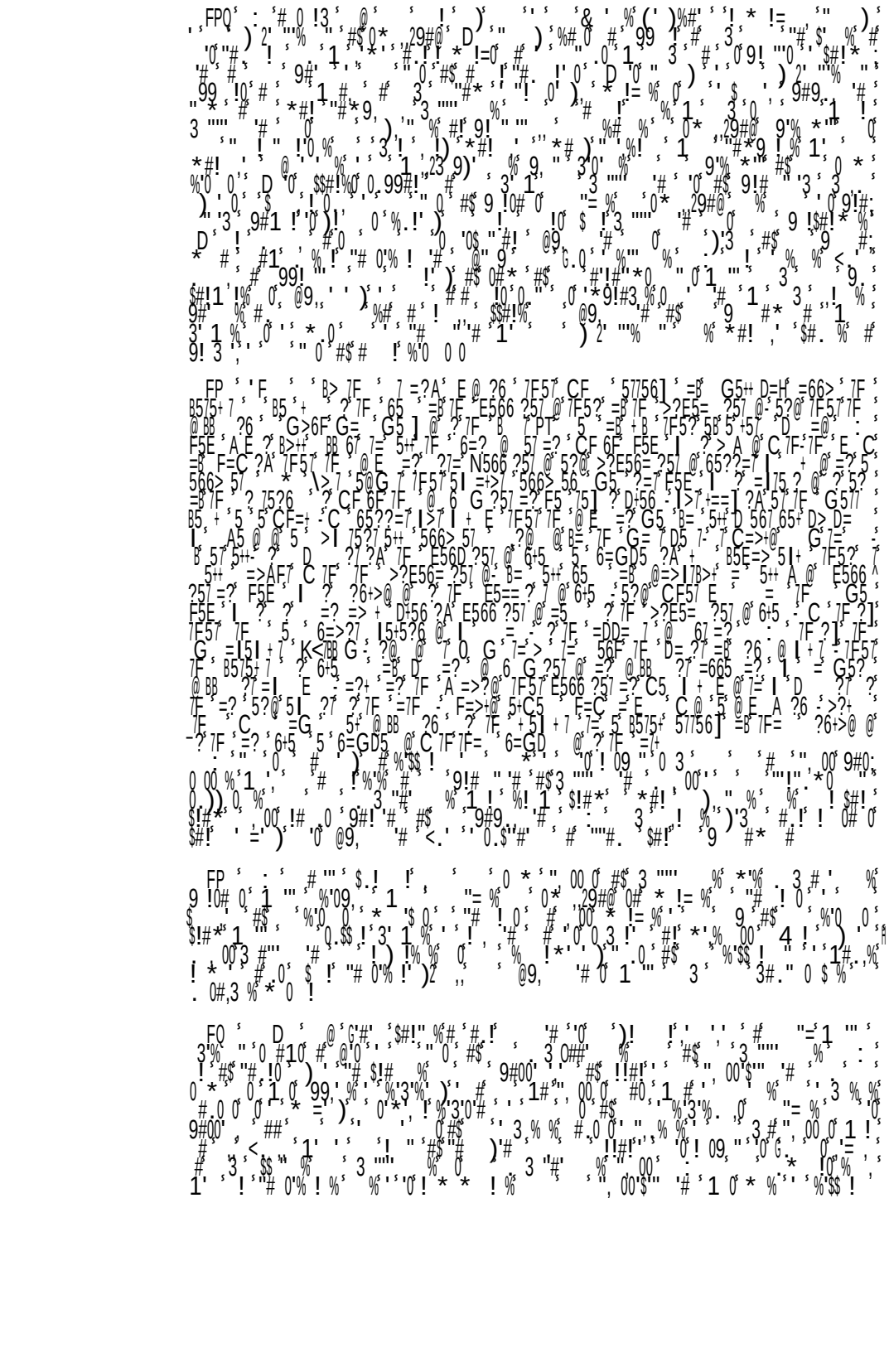

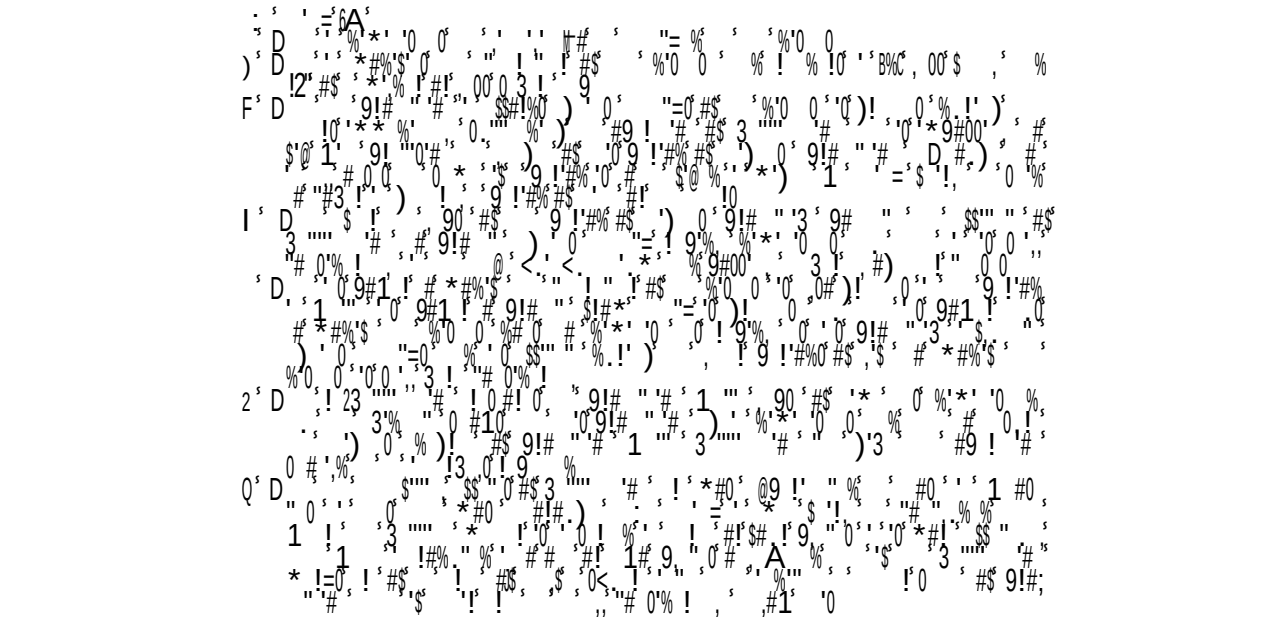

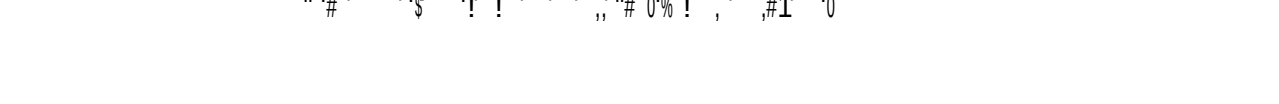

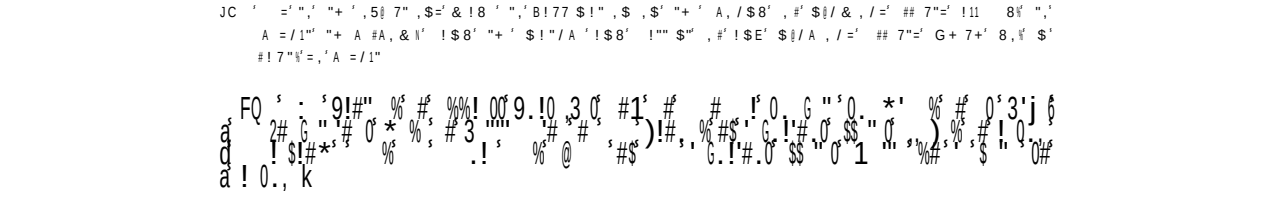

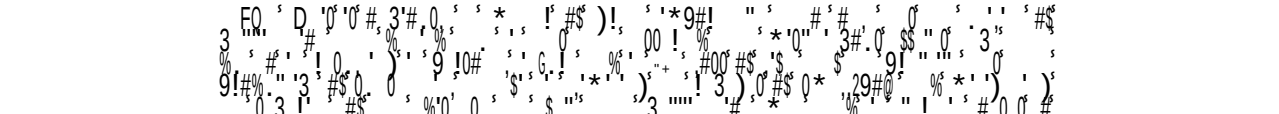

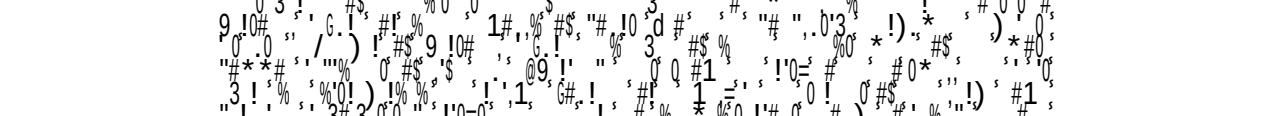

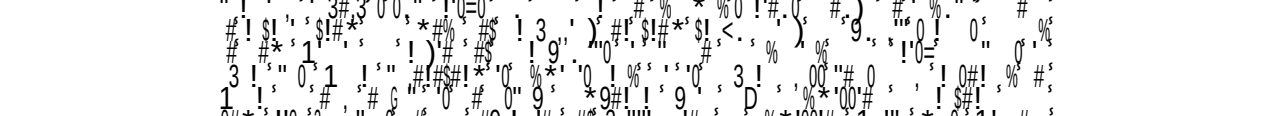

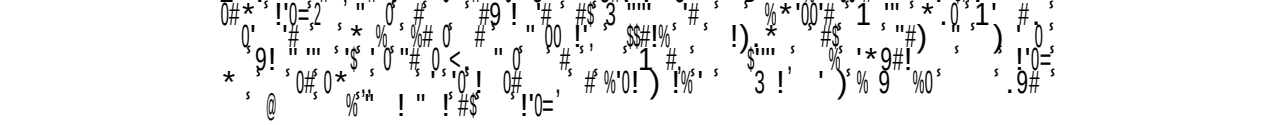

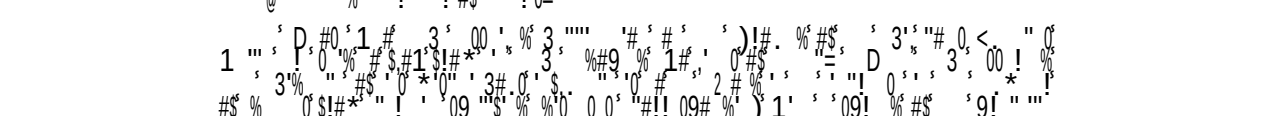

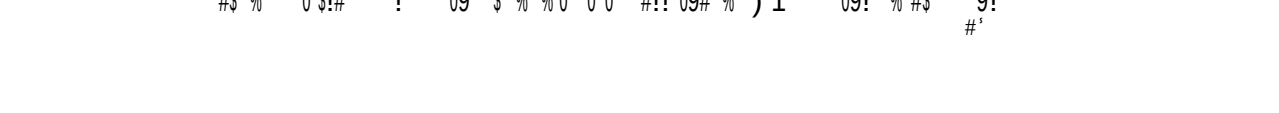

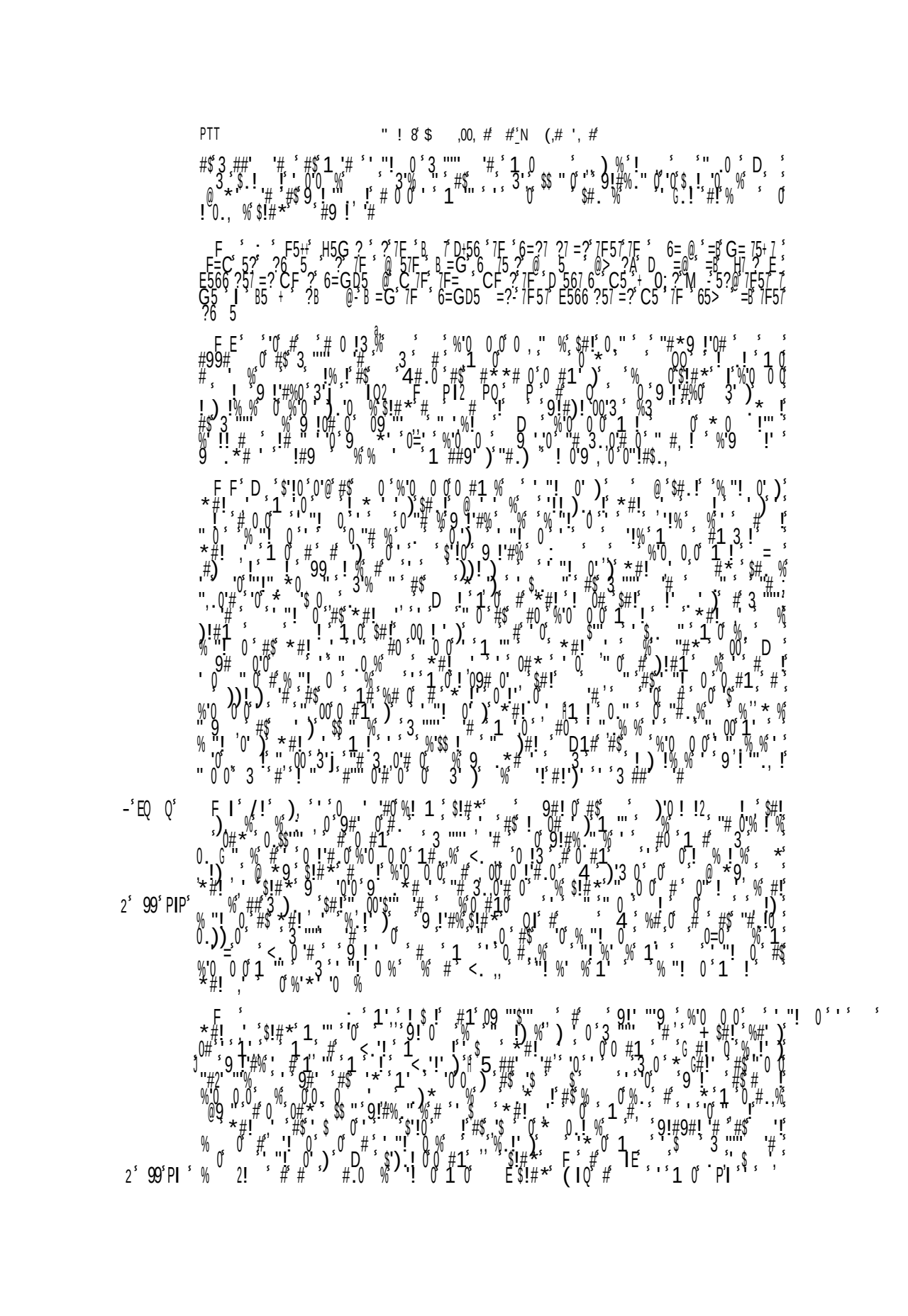

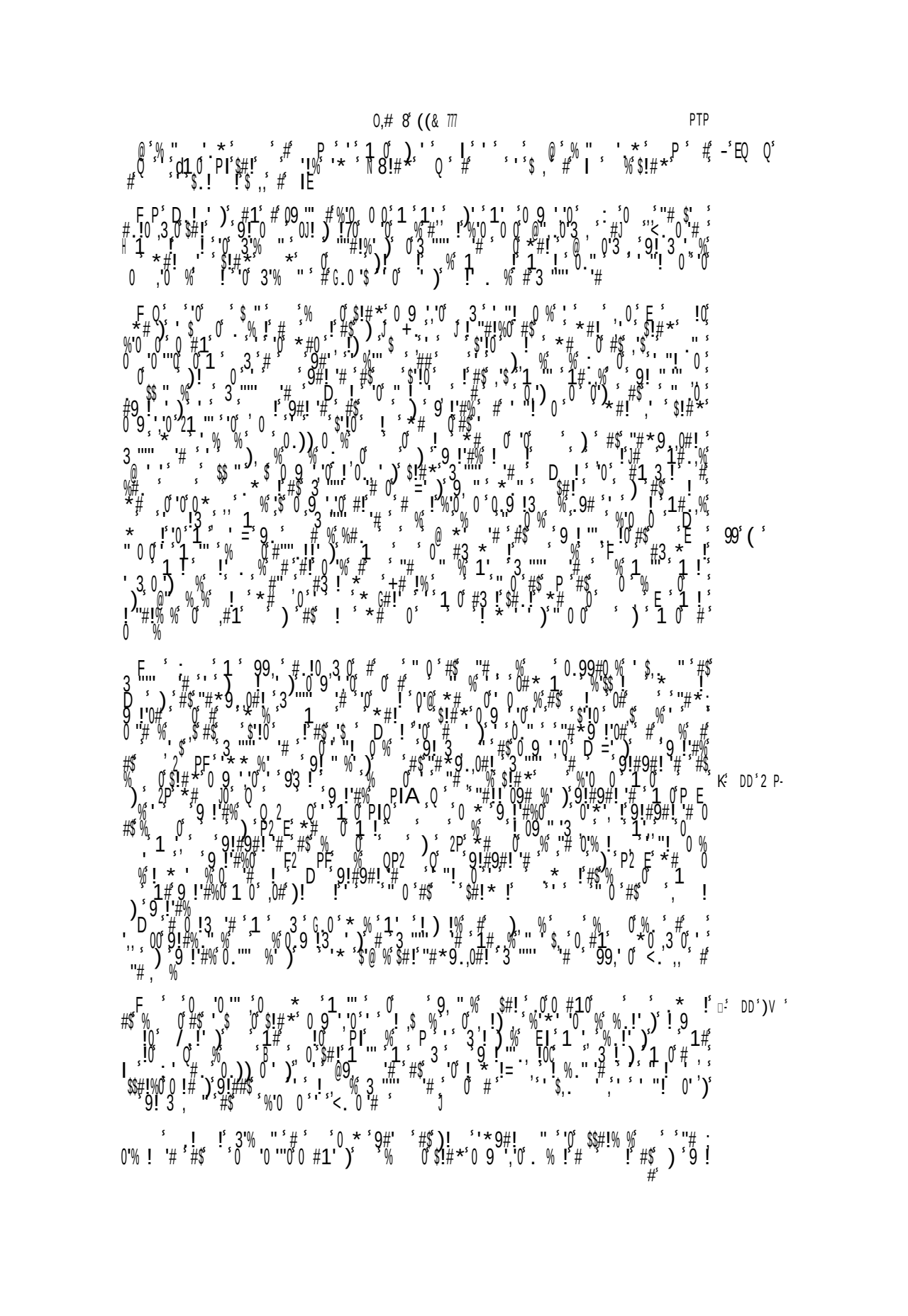

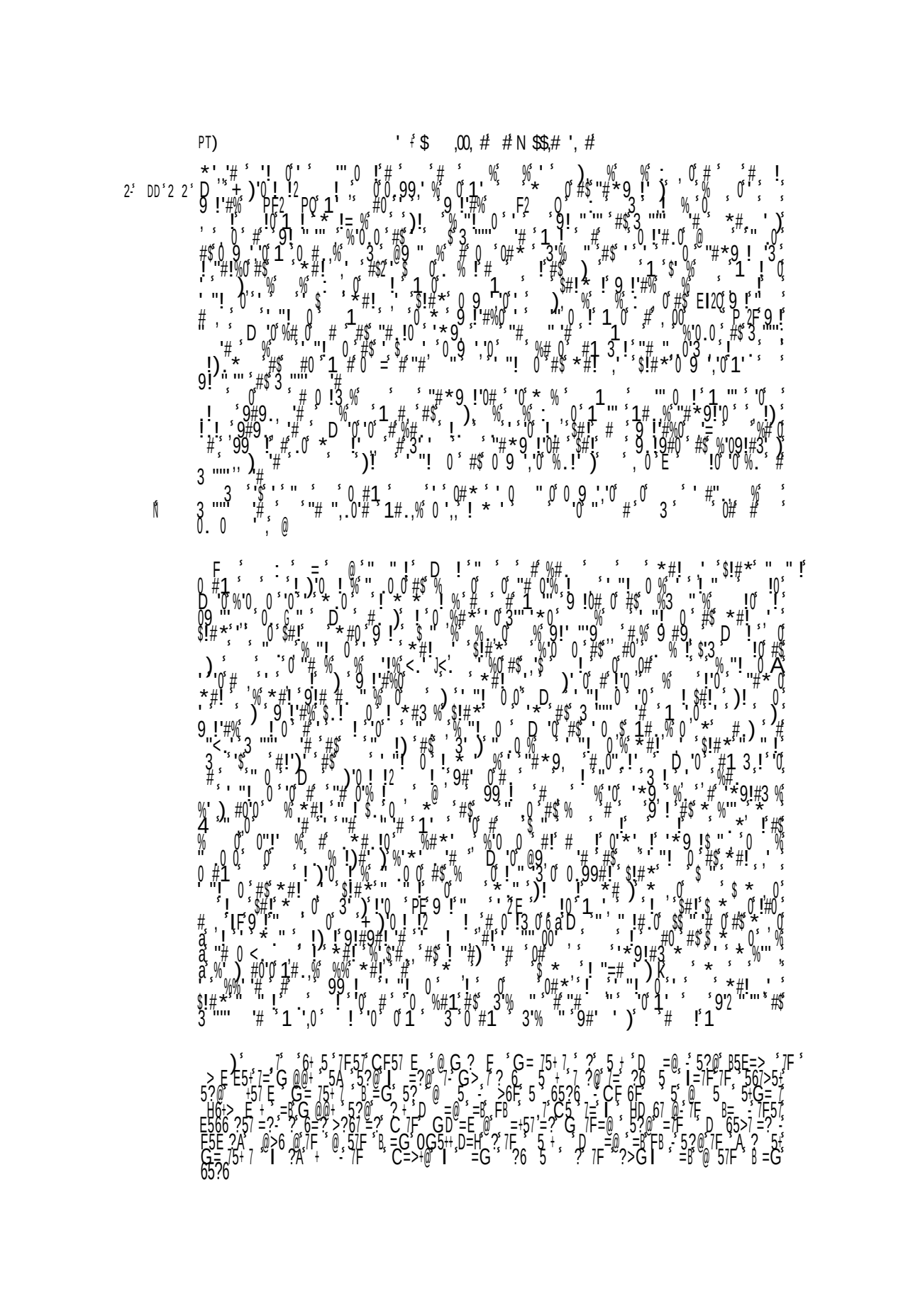

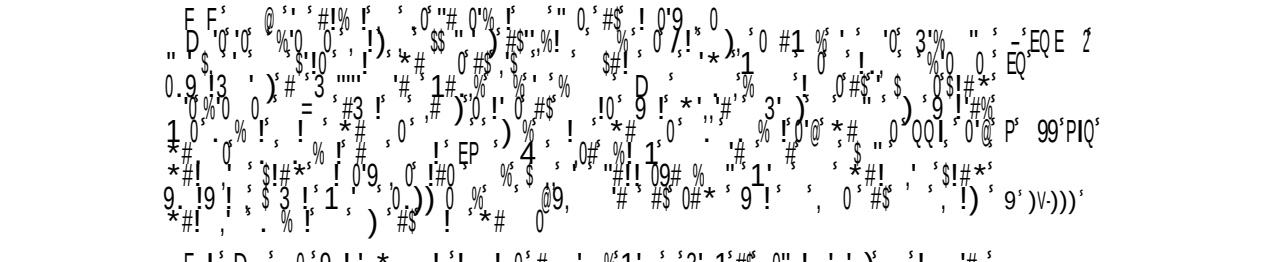

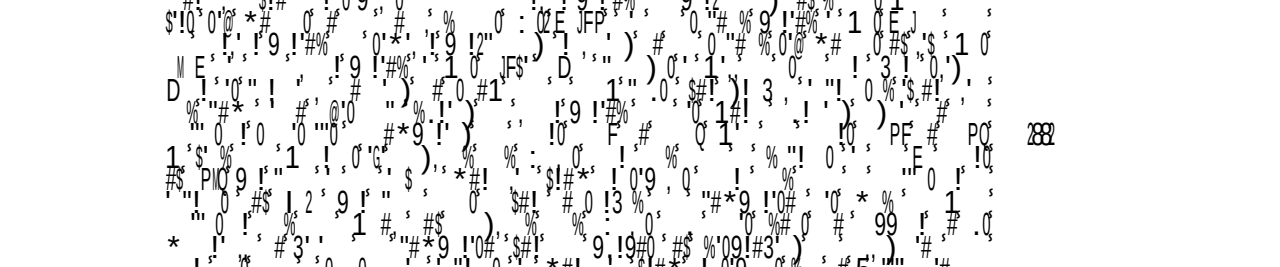

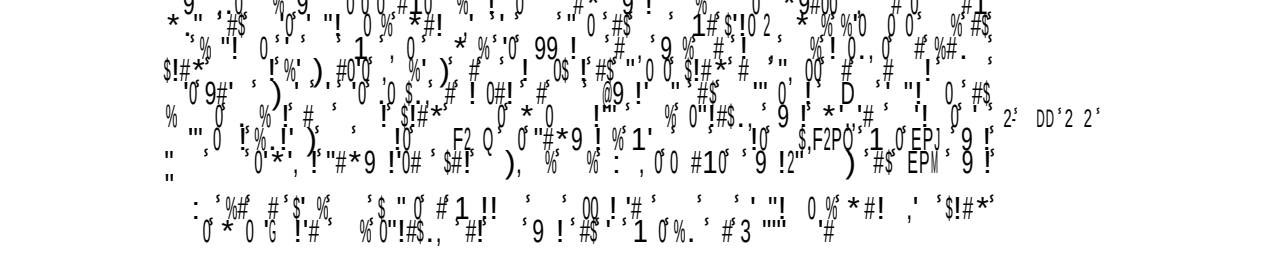

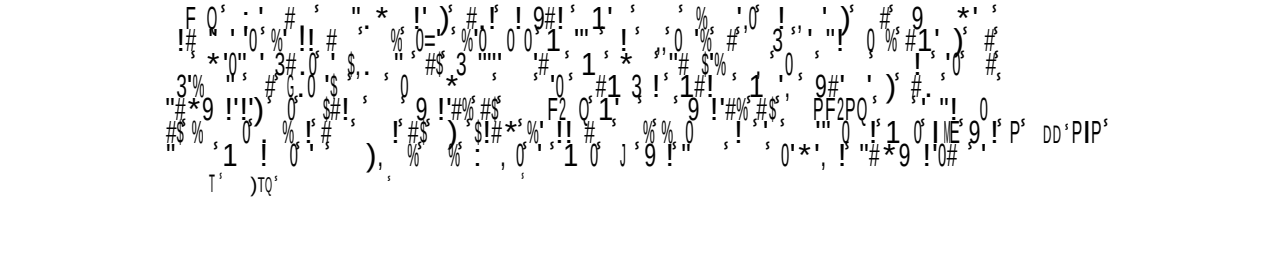

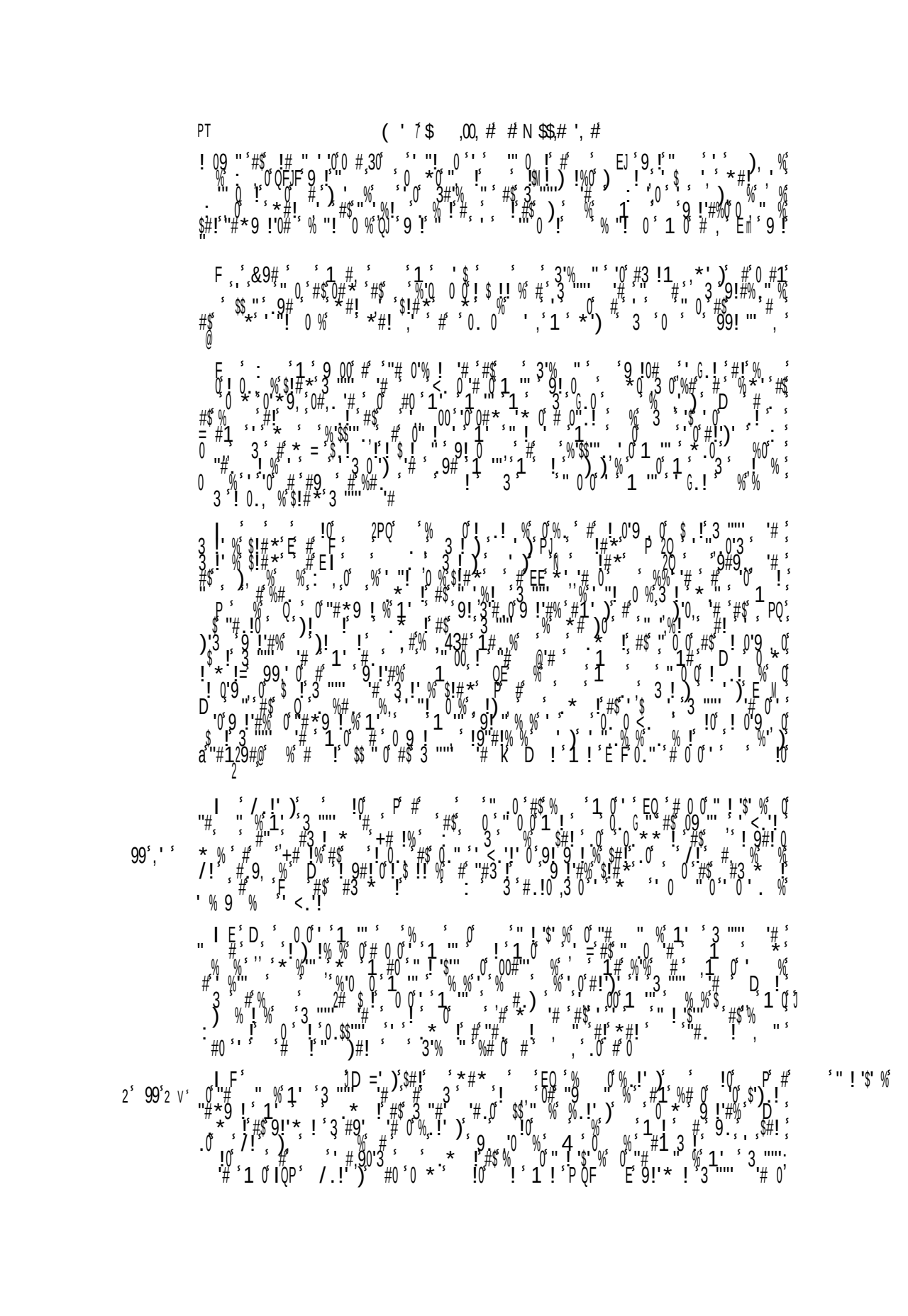

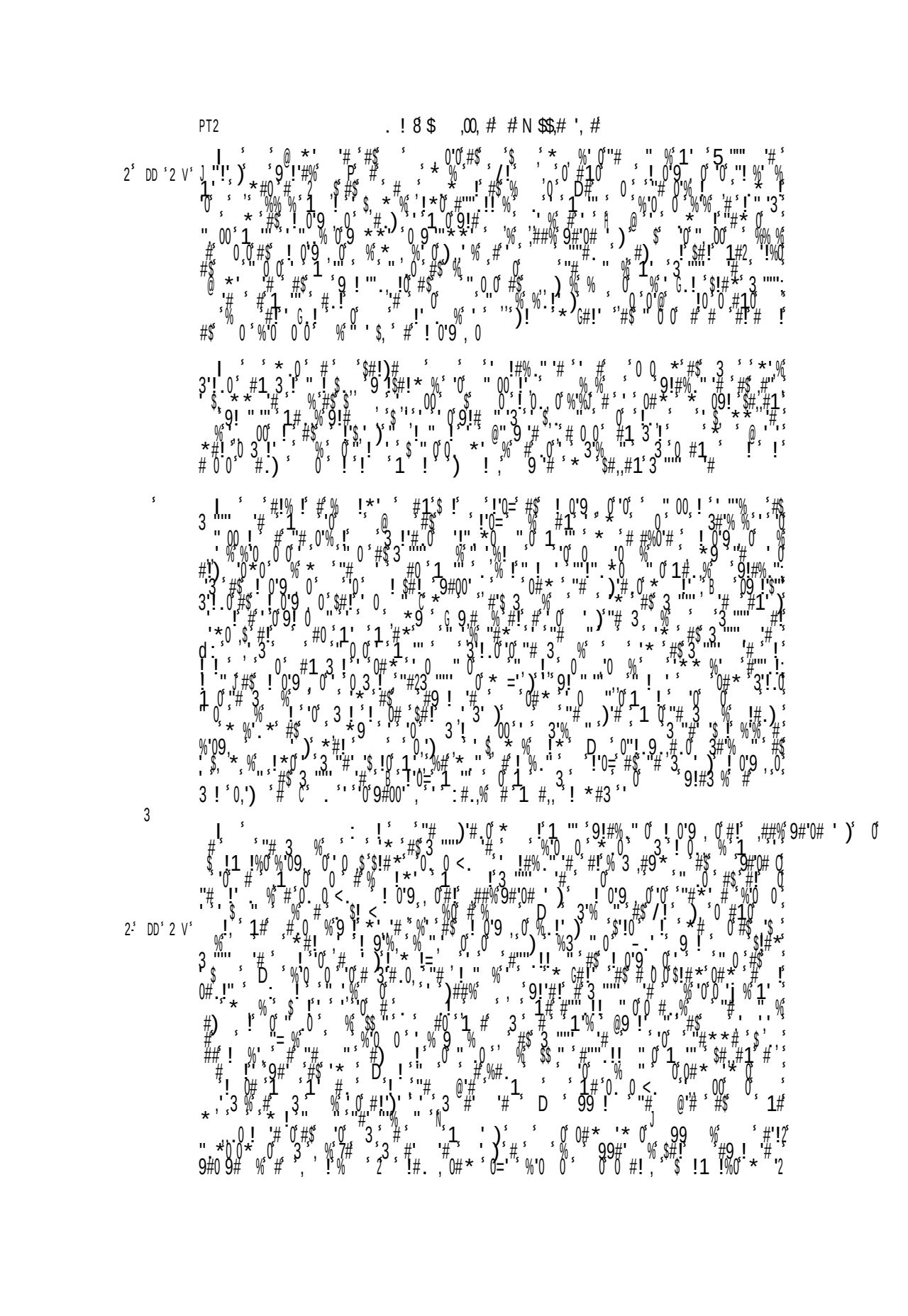

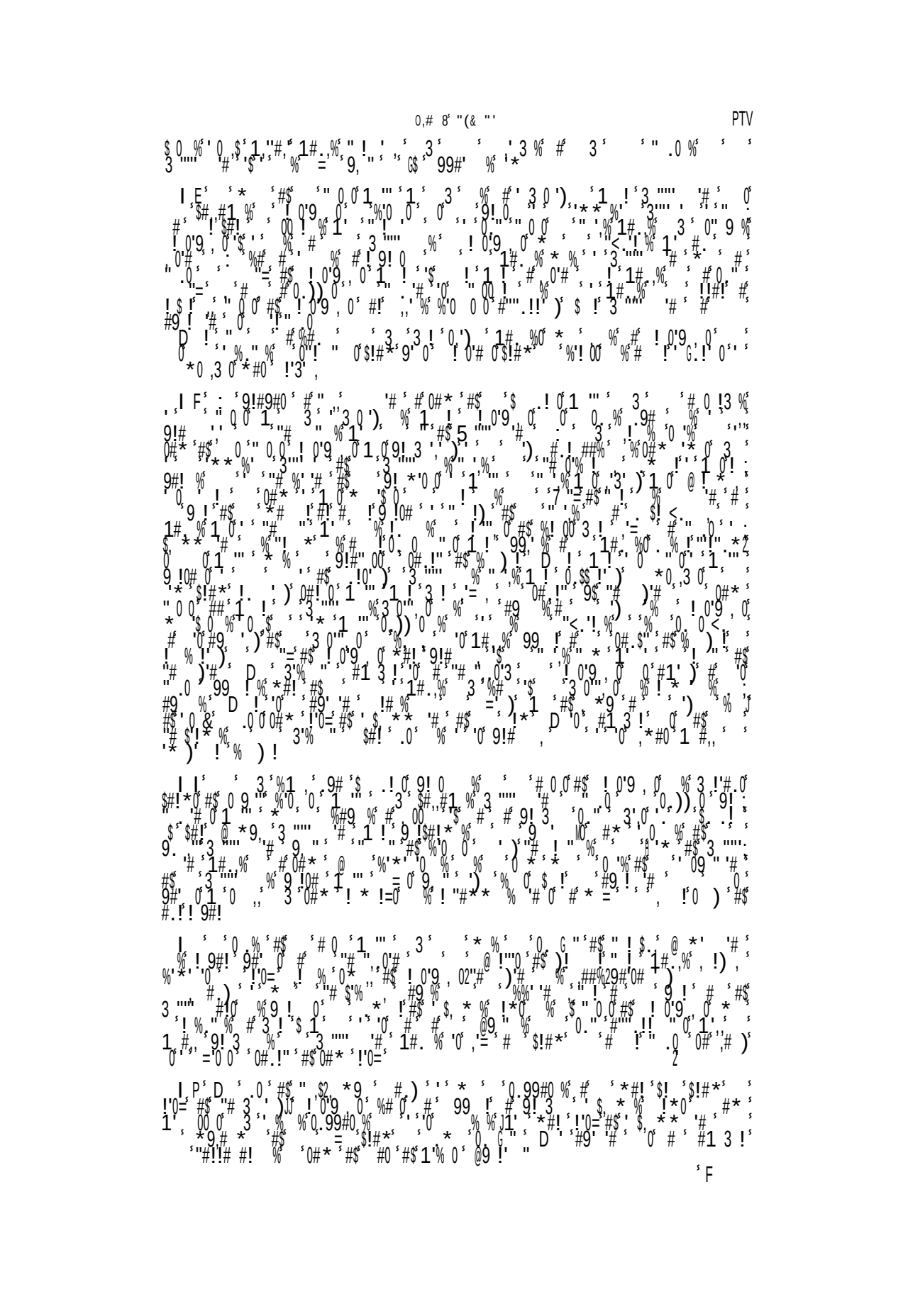

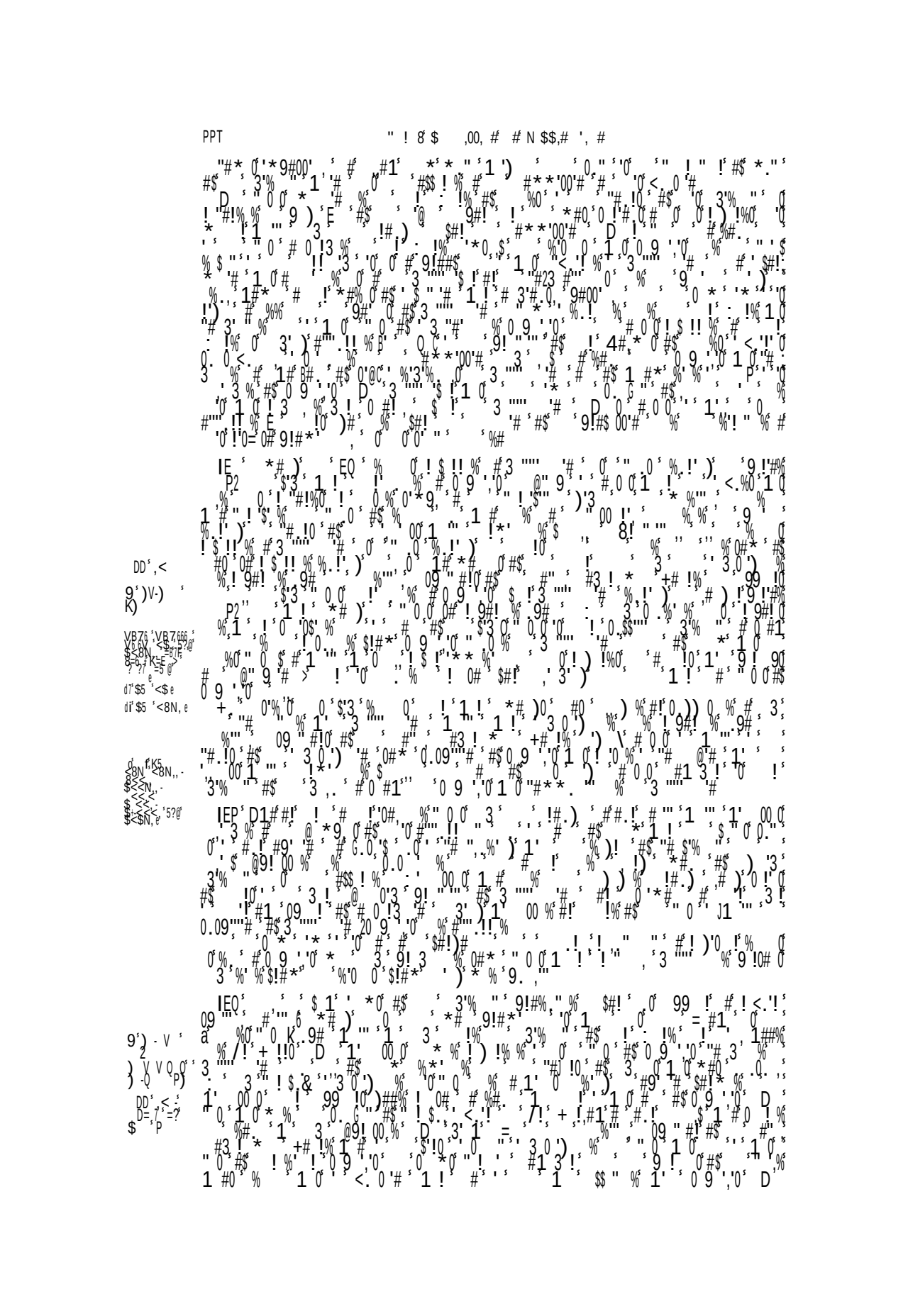

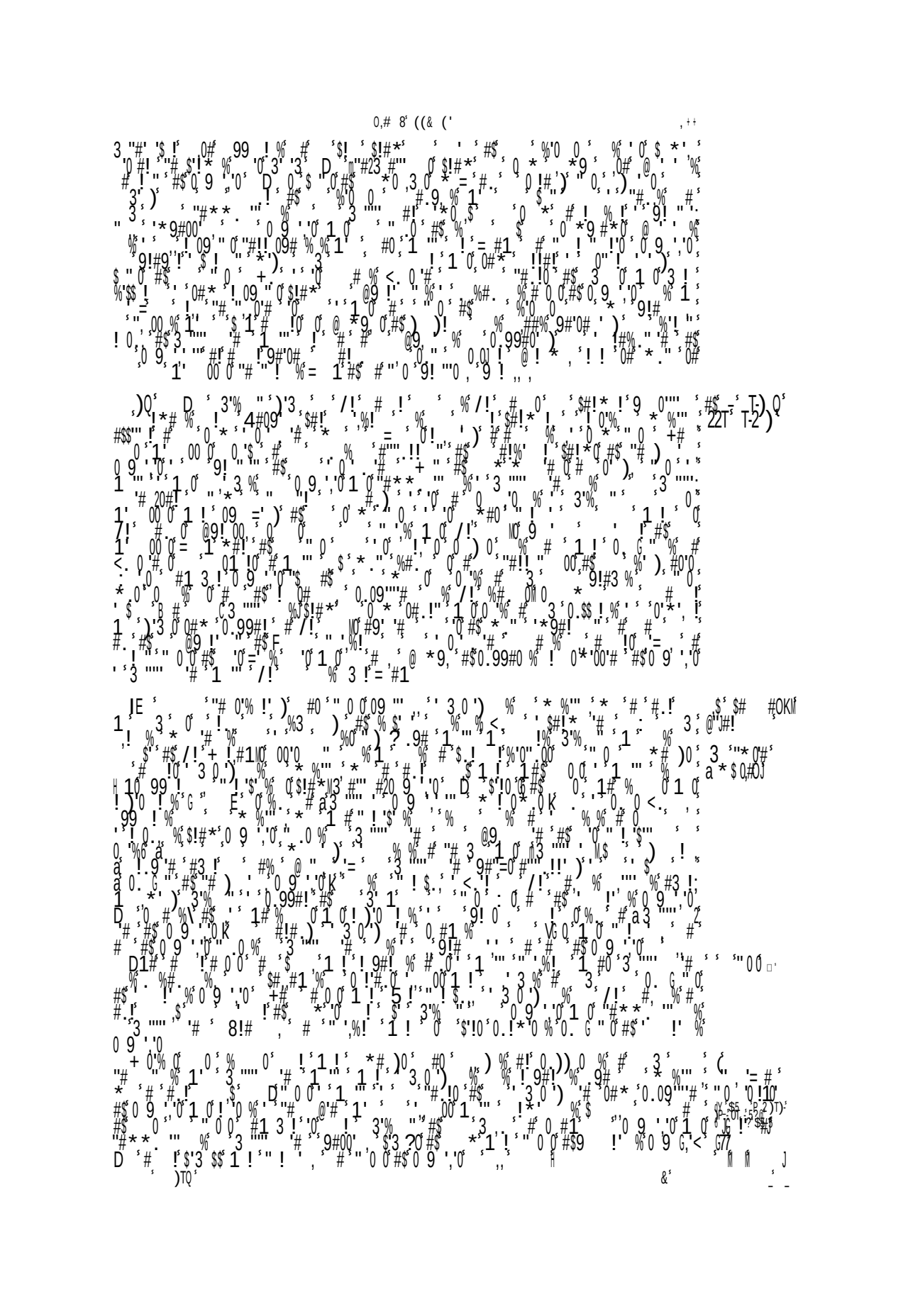

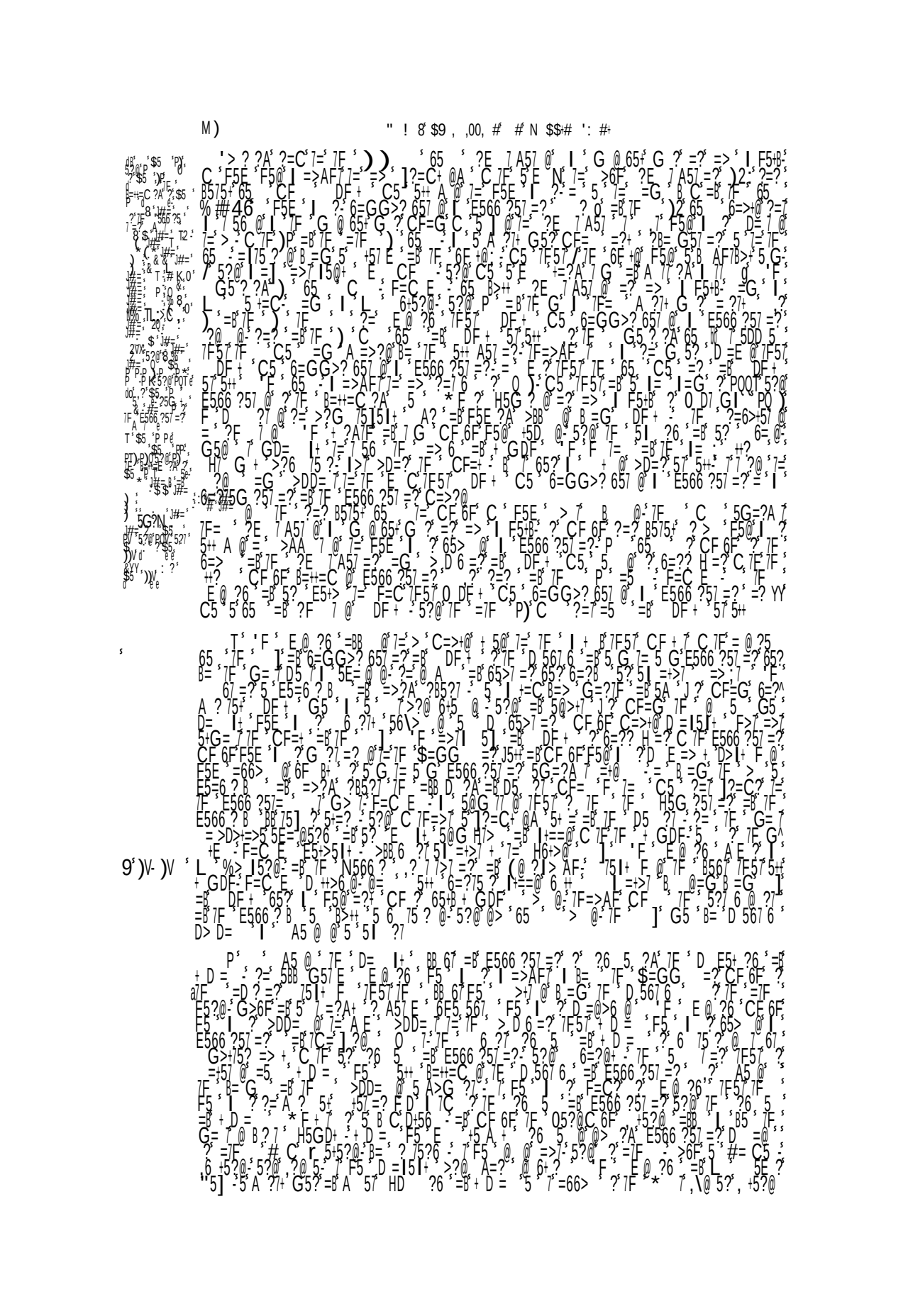

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P > 577 ?7 =? F5 I ? 65++ @ 7= 7F B567 7F57 ? =G C=]F=> ?B G5 5?@+ ?A ? F= D 75+ 7 F5 I ? 7F D 567 6 7= E566 ?57 6F +@ ? C 7F ? 5 B * @5 =B 7F I 7F +7F=>AF >?@ B5E=> 5I+ 6=?@ 7 =? E566 ?57 =? G5 I >66 B>++ 65 @ =>7 57 7F57 5 + 5A - C 7F ?] 7F D 567 6 7= I @ D 657 @ >?+ 7F I 57 7F 7 G =IE => @5?A =B G5++ D=H 6=?75A =? ? 7F H6 D7 =?5+ 5 ? CF 6F E566 ?57 =? I 6=G - =? 7F57 566=> ?7- ? 6 5 - 7F - ?B5?7 F=>+@- B D= I+ - I] D7 >?@ =I E5? =? >?7 + 7F 5 G F 5+ @ ?@ C 7F ?] 7F57- ? 7F 65 - 7 E >?@ 5I+ 7= E566 ?57 ? @ B E D+56 7F =D 57 =? F=>+@ I + G 7 @ 7= 5 ?A+ ? 7 =? =B 7F E566 ? G577

) 7>@ =B 7F D= 7 ? => D= =? +57 ?A 7= =5 ? CF 6F D +5 = D7 6 @ 5 F5 B=++=C @ E566 ?57 =? 7 56F ? =? G= B= 6 I+ 7F5? 7F [7F57 5? 5I 5 =? =B 7F E566 ?57 =? E 6+ I 6+=7F ?A =B 5 ?57> +] + 7= 757 7F G F=>+@ I 5E= @ @- 5?@ 7F5 B= A? >I 75?6 F=>+@ ?=7 I > I @ ?7=- 7F C=>?@ >?@ 6 6>G 75?6 65+6>+57 @ 7= 7 >D ?B+5GG57 =? 7 G= 7 GD= 75?7- 7==- 7F57 5? 5A = =7E G57 5+ 5DD+ @- 7= 7F D+56 =B E5== ?57 =? F=>+@ I 6 >^ D>+=> + 6+ 5? 'F C5?7 =B 65 ? 7F D 67 =? 7F D5 7 =B 7F D5 ?7 = D =? ? 6F5 A =B 7F 6F +@ F5 B =\> 7+ I ? 5 => 6 =B G 6F B B G= 65 C H 6 @ G>6F A==@ C=>+@ >7 &5 ?7 5?@ =7F G5?7 5?@ =B 6F5 A =B 6F +@ ? 5 B \> ?7+ >?5C5 =B 7F GD= 75?6 &5 ?7 G5?7 5?@ =B 7F E +7F57 5 C5 ? ?A =? 7F B=++=C B =G 5 @ A5 @ =B 7F G N 7F ?] C=>+@ I 5@@ @ 7= >6F D =?] F5 I ? 7F D 567 6 =B =G D>I+ 6 >I 67 F=>+@ I 5@@ @ 7= >6F D =?] F5 I ? 7F D 567 6 =B =G D>I+ 6 E566 ?57 7= 75] 7F 6=> 5I+ 7F57 7F D 567 6 F=>+@ I >? E 5+ 5?@ 7F57 7F 8=65+ K =E GG ?7 =5 @ F=>+@ 7+ 5 > 75] B= G 6=?75 ? ?A 6+ 5 5?@ GD+ >+ B= A> @5?6 ? 7F 65 =B 7F E566 ?57 @ 5 G- 5?@ B= 7F 5E= @5?6 =B 5?] => 6 = =B ? > 757 =? =B 7F57 D5 7 B 7F C @=? >?7=C5 @ ?6 @ ?7 G AF7- C 7F ?]- I +5 A + @ G ? F @

* F5E 5+ 5@ @ 5C? 577 ?7 =? 7= 7F B567 7F57 =G 65 =B @ 5 6=?7 567 @ 7F =>AF E566 ?57 =? G AF7 I 5E= @ @ B 7F =D 57 =? C D B= G @ 57 7F 6F +@ F=G - ? 7 5@ =B 57 5 D>I+ 6 E566 ?57 =? 757 =? 7 D ?7 7F 6F +@ F5 ?=7 >?B \M ?7+ I 5] 7C 6 5 6=? @ 5I+ F @ 5 =G 7 G ?E=+E =D 57 =? 7 +B- 52@ 7F ? B= 7F >I \> ?7 ? D =] => ? 7 @ 5I+ =B= 7F HD= > 7= ?6+ G ?7 C 51F CF 6F =B 7 +B- F5 5 @=> @ 7F 5 6=? @ ^ 5I+ ?>G I =B 6F +@ ? 5 =B7 ? 6=++ 67 @ I=7F =? 7F =665 =? =B 7F E566 ?57 =? 5?@ =B 7F - ? D 67 =?- 5?@ 7F] =B 6=?75A =? 7F I ?6 5 @ B 6F +@ ? C E566 ?57 @ 5?@ ? D 67 @ 5] 5 >+ 57 7F =C? F=G - ? 7 5@ =B I ?A I =>AF7 7= 5 D>I+ 6 757 =?- C I + E 7F] =B ? > -C=>+@ I ? I+ + ? @

G @ 65 G5? 577 ?@ ?A 57 7F 6F +@ @ ?6 C=>+@ I 7 5I+ 7F5? 7F D>I+ 6 E566 ?57= @ ?5 + 65? I 7= >@A CF 7F 6 6>G 75?6 G5@ 7 HD @ ?7 7= D= D? E566 ?57 =? B= 5 7 G F ? 5? 75 6=?@ 7 =? ? CF 6F 5 6F +@ C5 + E ?A F5E >D E ? @ =? E566 ?57 =? HD+5?57 =? =B D7 6 @ 5 CF 6F F5E >D E ? @ =? E566 ?57 =? 6=?@ 7 =? C=>+@ I 7 I 7 5 G @ 65 G5? E ?A 7F F=G 7F57 I 5 D>I+ 6 E566 ?57= 7= CF= 757 =? 5 6F +@ I =>AF7

' E 65? I ?= @=> I7 7F57 E566 ?57 =? =>AF7 7= I D= 7D=? @ CF ? D +5 - 65 + 7 B E - G 5 + - = 6F 6] ? D=H 5 D E5+ ?7 ? 7F ? AF I=> F==@ =B 7F 6F +@ - @ ?6 - = - B 7F 6F +@ ? =7 7= I E566 ?57 @ 57 F=G - 7F 7F = ? 5 7F D+56 =B E566 ?57 =? % 5A5 ? 7F C=>+@ I 5 A5 ? B 7F F=G C5 G= =B7 ? 7F D+56 =B E5= ?57 =?

2 ,7 C=>+@- ? => =D ? =?- I 5? 5@E5?75A B 7F D= 7D=? G ?7 =B E566 ?57 =?- C= HD + D G 7 @- ?= 7 =?+ =? 566=>?7 =B 7F 757 =B 7F 6F +@ F>7 =B 7 > =>?@ ?A 5?@ 5? =7F 6=> + 7 =? ?@ ?A 7F =D 57 =? 57 7F 7 G >?@ 5I+ ,B G= @ 6 7 =? ? 7F D 67 C D= @ 5?@ H 6 @- C 7F ?] >?7=C5 @ >+7 C=>+@ I 6=G E ? 5 7F5? 7F 5

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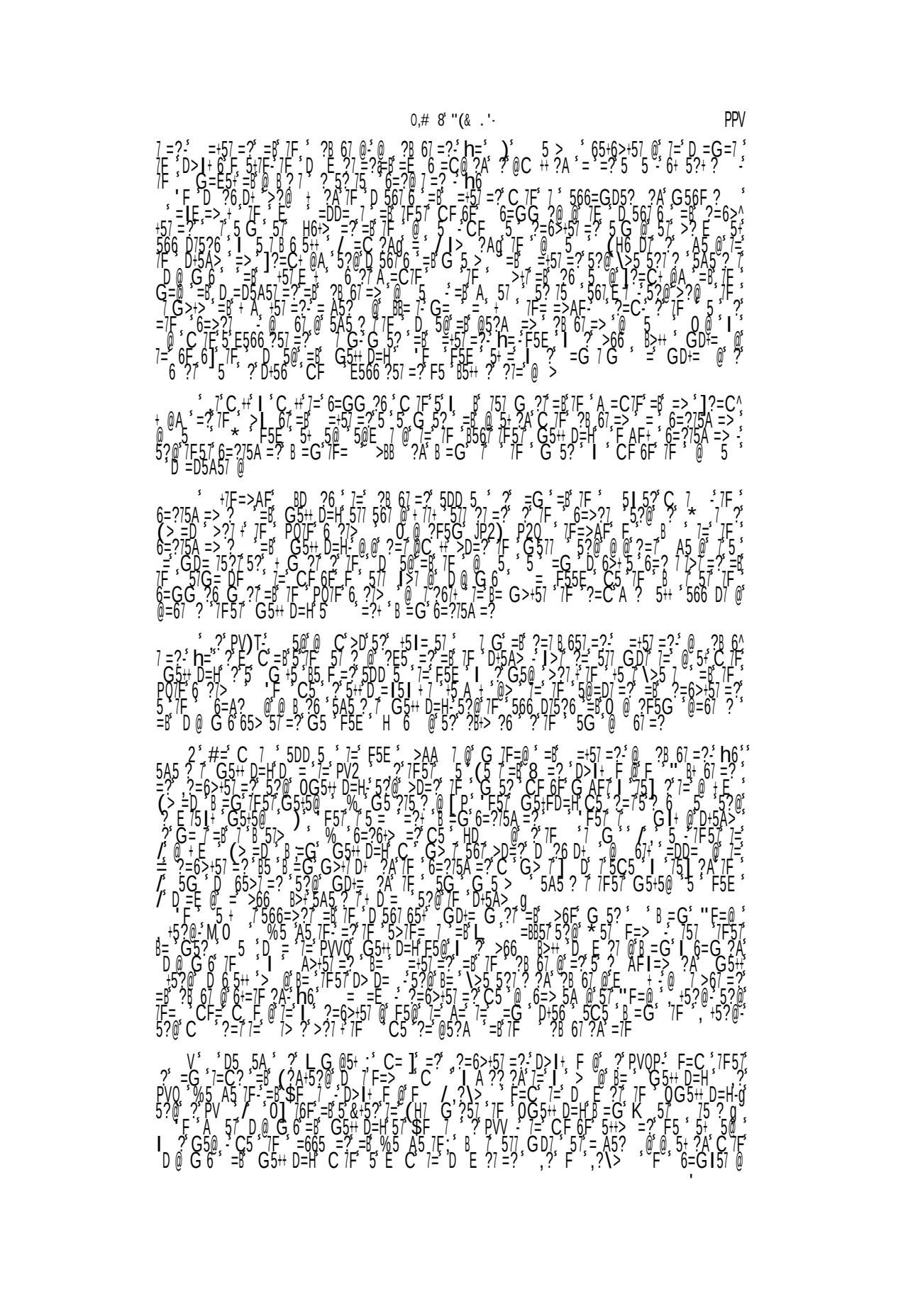

0 @ ?F5G,;' @=67 ? ' 7F5 7' D @ G 6 ' 5 ' +?' =G ' =66>+7' 6=?@ 7 =?' =B' 7F ' 57G= DF -' 5?@' 5 A> @' 7F57' G5++ D=H' C5 ' 5+C5 ' D 5@' I ' ?B 67' =?' =?+ %' B> 7F ' G5 ?75 ? @' 7F57' 7F ' E5 ' =+=> ' D= =?' 6=>+@' I ' 65 @' 5 ' 5? ?B 67' =?' B= ' 5 + 77+ ' @ 75?6 =?=' 7F =>AF' 7F ' 5 ' 5?@' 7 6=? \> ?7+ 5 7' 7+ 5 7' 7F G5++ D=H' G5 I ' 7' D E ?7 @' I ' I D ?A' D =? ' + 5I+' 7=' 7F ' @ 7 GD ' B =G' 5DD =56F ?A' C 7F ?' 7F ' = ?B 67' => @ 75?6 =B' 7F ' E5 =+=> D= =?' 7 ++ 7 65?' I ' @ 7 = @ G ' F E C + @ F G ' >D=?' 7F 7> ?' =B' 5?' D @ G 6 ?' PVVV' 7=' D =D= ' 5D 5?' B= '7F ' D E ?7 =?' =B' 7F ' ?57> 5+ G5++ D=H' 5?@' ?' PVVQ 5' =6 7' C? B= G @' 7= 65?' =>7 7F ' D+5?' ?' $F 7 ' F D+5?' 6=? 7 @' =?' 7F ' ?E5?@' =B' 5 A ?' 5+ ?=6>+57 =?' 57D =D+ ' F=G ' 5?' 757 @' ?7 E5+ ' =?' 7F ' A =>?@' 7F57 7F ' ?=6>+57 @' G5++ D=H' C5 ' B5 ' + B5?5+' = ' ?' > =>' 7F5?' 7F ?57> 5+ G5++ D=H' 5?@' =?' 7F ' =!F F5?@' =B' I ' >+ =B' & E ?7 =?' G I5 @' =?' %5 A5 7F ' E C ' =B' ?B 67' =?' ?' 7F ' D= ' =B' 7F ' =6 7 ' 65++' @' ' F= ' 7+ ' g ' F ' OG5++ D=H' O=6 7 -g @57 @' O D7 G' I PVQ) ' 7 757 @' 7F57 ' ?F ' 5 =B' 7 ' H ?6 7C=' A ?' 5+ ?=6>+57 =?' 7F5@' I ?' F +@' 5?@' 7F57 7F ' 57F ' B =G' G5++ D=H' F5@' I ?' A 57+ ' + ?' @' K 57' @ BB 6>+7 - F=C E ' C G ' C ?F ' /' +5 A ' D =' /' D= 7 =?' =B' 7F ' ?F5 I 75?7 ' g B> @' =?' ?=6>+57 =?' 5?@' 5 +5 A ' D ?' = 7 =?' 5+ =' / I ?A' /' B 5 + -' =' 57F @' => - 7F57 7F ' 6F +@' ?' F=>+@' F ?B 67' @' C 7F 7F ' ?57> 5+ /' G5++ D=H;g B> @' 7=' =I ' 7F ''>+ =B' & E ?7 =?' % ?6 - 7F=>AF 7F ' 5G /' D= 7 757 7F57 7F H5GD+ ' =B' $F ' 7 ' F5@' I ?' B=++=C @' I 8 E D==+' C+ ' - / 5 /' A ?' 5+ ?=6>+57 =?' C5 ' >66 B>++ ' H 6>?' @' ?' 7F ' 5>7>G ?' =B' PVQP' 5?@' 5?=7F ' ?' 7F ' D ?A' =B' PVQ) -g' 5?@' ?' 8 @ - CF ' 5' A ?' 5+ ?=6>+57 =?' C5 ' F +@' ?' PVQP' 5?@' 5?=7F ' D =D= @' ?' PVQ) - C 7F ' >6F ' >66 7F57 7F ' '' = 5+ $=++ A ' =B' &F 6 5?' ?' (@ ?' I> AF 5DD= ?7 @' 5 6=GG 77 ' 7=' ?\> ?7=' / 7F ' G=@ ' =B' 6=?@>67 ?A' 7F ' /' A ?' 5+ ?=6>+57 =?' =B' 7F D== ' g 7F>' 5 @=D7 @' ?' 7F D+56 - 7F D+5?' G 7 C 7F ' >6F @ BB 6>+7 - 7F57 7' C5 ' >+7 G57 + 5I5?@=?' @' ?' 7F C ++ I =I F @' 7F57 7 5 A ?' 5+ ?=6>+57 =?' C5 ' 5?' ?7 5+ D5 7 =B' 7F ' D+5?' =D= 6 + 5?@' 65 @' =>?' ?' PVVQ D) ' I>' - C ?A' ?' PVQ ' %5 A5 7F +==I @' B= C5 @' 7=' I ?A' 5I+ >+7 G57 + 7' ?' PVQ ' D ?' C 7F ' ?=6>+57 =?' 5?@' ?' 7F D B56 7=' F +57 @' 7 =?' D>+ + F @' ?' +V - F ' 757 ' G= @ B ?' 7 + 7F57 7F ' 5@=D7 =?' =B' F '' >+ =B' & E ?7 =?' C 7F =>' 5?' A ?' 5+ ?=6>+57 =?' G AF 7 H7 G ?57 G5++ D=H' ?' =G ' 6=>?7 =!F 7F5?' K 5?' 75 ?' @' G>' I ' G GI @' F=C E - 7F57' %5 A5 7F ' ?' 75 ?' @' 7F ' =D ?=?' 7F5?' 7F ' ?B 67' =?' =B' G5++ D=H' 6=>+@' ?=7 I 65 @' 7F ' =>AF 7F ' 5 5I=E 5 5I=>7 F5+B 5 5 @' 5?@' 7F57 ?=' =?' 6=>+@' F ?B 67' @' I 7F ' 6+=7F ' =B' 5 D =?' E ?A' 5 ' G5++ D?H' D57 ?' D =E @' 7F57 F I D7 I =?@' 7F ' @ 75?6 =B =G 7F ' 57 6?7 7 =!E => 7F57 ' B' 7F ' F5@' I ?' 75I+ F @' 7F ' 6=?7 =+' =B' 7F @ 5 I =+57 =?' C=>+@' I 5' G>6F GD+ G577 7F5?' 7' 5++

Q ' ?' 7F ' @ 6= F > A =5' '' E C' B= ' PV 2 7 = 6' 5 D 5 6+ 5?' 566=>?7 =B' 5' *= I ' L ' &5?' 7 =B' 8 D =' ?7 7+ @' / ?' 5 =?' 7F @>7 =' B' G5?' 7=' D5 57 D =?' / 7F5?' @ 5 \>5++ B =G' 7F 7=CF ' 5G '6=>?7 =B' (> =D @' ?' CF 6F 5++ 7F ' 7' C5 ' 5 A> @' 7F5?' 7F B 7 D =?' ++' ?' 5' D+56 7F =?+ =>' 6 B' =G' CF 6F 5++ 7F ' 7' D 5D F>?@' @' 5?@' 7F=> 5?@' I 6=G 5BB 67' @' 5?@' 7F57 @' F C D>' GG @' 57 + ' ?7=' 5 7>57 =?' CF F 6=>+@' ?=?' ?' > I =' +5=?7F= CF= F5@' ?=?' F5@' 7F @' = @ ' 7F D 5@' =B' 7F ' @ 5 C=>+@' I ' D E ?7 @' ?' 7F 5G '' E C B= ' PV 5DD 5 @' 5?' 566=>?7 =B' 75I+ FG ?7 ' B= ' 7F ' H7 D5^ 7 =?' =B' G5++ D=H' ' F B5 +5 ' =B' ?=6>+57 =?' 7=' 5?75 ?' 7F @' @' ?@' B @' 7=' 5?@' + A +57 =?' > A @' 7= B56 + 757 =+57 =?' ' B> 7F ' 75?' @' 7F57 ?' PV 2 7F ' & > 5?' $=++ A ' =B' &F 6 5?' D= 7 @' B5E=> 5I+ 7=' 7F ' ' ?A' =?' 7F ' D = 67' 5?@' 7F57 ' %5I 75@' 7 F5@' 7 ?' =+F @' 7=' 75I+ F 5' F=> ' B= ' 7F ' D> D= 7 $27 @' ? & 5?6 5' G +5 ' D+5?' F5@' I ?' 7 @ C 7F >66

' ?' PV Q ' ?? ' ?\> ' C5 ' D>I+ F @' 5?@' ?' 7F ' 5 + ' 5 ' =B' 7F ' 6 ?7> ' ?=6>+57' =?' I A5?' 7=' I ' @' 6=> 5A @' B= 5' C+ + 7F ' D ' = D 67 ' =B' 5?? F +57 ?' A G5++^ D=H' I E566 ?57 =?' 5DD 5 7=' F5E ' >D @' @' ?' 7F ' G ?@' =B' G5?' ' 7F ' D+5?' =B' %5 A5 7F 5?@' =!F Q=G E566 ?57=' F=C E - + I * ++5?' 5?@' '' ?A' 7 ++ +==I @' 7=' G 7F=@' =B' \>5 5?7 ? 5?@' 7=' ?57 =?5+ 5?@' G>? 6 D5+ A>+57 =?' D =G=7 ?A' =+57 =?' 7=' H7 G ?57 7F G5++ D=H ' C=' 7F ' =B' ?=7 6 - 7=== 7F5 %5 A5 7F F G +8 ?' 5 + 77 ' \>=7 @' I ' 5DD ' =B' I =' I ' ?' 5' 6=GG>? 657 =?' 7=' 7F 8=?@=?' @ 65+ 5?@' &F 65+ ' => ?5' JN=+ N ' D ' J ' @57 @' 67=I ' P 7F- PQTT' G5 I @' /' =?' 7?' =@>67 =?' =B' 7F ' E566 ?' 7 ++' G= ' /' 7F5?' =B' 7F E5 =+=> ?=6>+57 =?' C=>+@' +B 6+>5++ ' D =G=7 7F A 57 =I 67 =B G ' /' D>I+ 657 =? g

2T ' & =' 7=' 7F ' 5 ' PQ22' 7F ' C5 ' ?=' D =F =?' G5@ ' I ' +5C ' B= ' ?5I+ ?A' 5? 75 ' 5>7F= 7 7=' 75I+ F F= D 75+ B= ?B 67 => @ 5 ' 5?@' 7F>' 7= D =G=7

7F ' ,=+57 =?' =B' >6F' 65 ' ' 'F ' =?+ ' ,? 7,7>7 =? ' ,=B' 7F57' @ 6 D7 =?' 7F, ?' H 7 ?A' C 7F, >+7 =B' D F57 ' BB= 7 O= B5 ' 5 A5 @ G5++ D=H' 7F C5 - D 567 65++ D 5] ?A-' ?= D =E =? B= ' 7 7 57G ?7 I G 5? =B =+57 =?

2P ' ' F ' O5? 75 ' 67' =B' PQ22' GD=C @-' 7F=>AF' 7' @ @' ?=7' 6=GD +' ,@ 5' 5>7F= 7 7F =>AF=>7' (?A+5?@' 5?@' *,5+ ' Q6=7+5?@- 5?@' ,+5?@-7= D =E @ ' =' 7=' = ?' ?' D =E @ ?A' =+57 =?' F= D 75+ ' B= ' 7F ' > =B 7F ' ?F5I 75?7 =B 7F @ 7 67 ' F C5 ' B>7F + A ' +57 =?' =?' 7F ' >I 67' I ' 7F ' &>I+ 6' % 5+7F' 67 ' PQV ' 7F ' &>I+ 6' % 5+7F' J8=?@=? ' 67 ' PQ P ' 7F ' &>I+ 6 % 5+7F' J O6=7+5?@' 67 ' PQ2V ' 5?@' 7F ' &>I+ 6' % 5+7F' J ' +5?@' 67 ' PQVQ ' ?7=' 7F @ 75 + ' =B ' CF 6F 7 ' ?=7 ? 6 ' 5 7=' ?7 ' F G=' 7 6 ' ?7 ' 67 ' +57 2A' 7=' 7F G57' 7 ' =+57 =?' %= D 75+ ' 67 =B' PQ ' CF 6F 5DD+ ' 7=' 7F ' G5++ 7=C? ' 5?@' > 5+ @ 7 67 =B' (?A+5?@' 5?@' * 5+

2) ' ?' 8=?@=?' 7F ' +=65+' 5>7F= 7 ' 7=' CF=G' 7F ' D=C ' 7=' D =E @ ' =+57 =?' F= D 75+ ' C5 ' A E' ?' I 7F O5? 75 ' 67 =B' PQ22' C ' ?' 7F ' $ 7 ' 7F ' $=GG ' =? =B' O C 5?@' ?' =7F ' G 7 =D=+ 75?' @ 7 67 ' 7F ' N ' 7 ' =' L 7 67 =5 @ * 7F' B C' H6 D7 =? ' 7F 5>7F= 7 @ @' ?=7 H 6 ' 7F D=C 6=?B @ =?' 7F G-' 5?@-' D 5] ?A' A ? 5++ ' 7 G5 ' I 5 @' 7F57 7F ' O5? 75 67 =B' PQ22' F5@' D 567 65++ ' ?=' BB 67 ' ?' 8=?@=?' 5 ' A5 @ 7F ' D =E =? =B' F= D 75+' 566=GG=@57 =?' B= ' G5++ D= ' O=G ' B C' =B' 7F G 7 =D=+ 75?' C=]F=> ' F=C' E - F5@' ?B 67 =>' C5 @ ' 57 756F @ ' ?' CF 6F =5 =B' G5++ D=H' C 7 57 @- 5?@' 7F A>5 @ 5?' =B' =G ' =B' 7F >? =?' @?' =5 I ' 5 5?A G ?7 7D 7F ' G5++ D H F= D 75+' 57 % AFA57 F ? 7 7>7 =?- CF 6F F5@' I ?' 75 I+ F @' ?' PV 2' C5 ' H7 ?@ @' ?' PQ T =5 7=' D =E @ ' 566=GG=@57 =?' B= 5 I=>7' PTT G5++ D=H' D57 ?7 ' ,7' G5 ? @' @=C? 7=' 7F 5 ' PQVT 7F =?+ ' G5++ D=H' F= D 75+' ? 8=?@=?

2 ' ' F ' =IF =>' @, BB 6>+7 ' 5?@' @5?A, ' 577 ?@ ?A' 7F, ' 7 57G ?7' =B' D =?' ' >BB ?A' B =G' G5++ D=H' ?' 7F 5G ? 7 7>7 =?' ? CF 6F' =7F @ 7 7>7 =?' ' D =?' ' 5 D 567 65++ B= 6 @' 7=' @' + @' 7=' 7F' ?567G ?7' =B' 6 75 ?' D =E =?' =B' 7F ' 7 =D=+ 75?' &== ' 6' =B' PQ2V' 5?@' 7=' 7F' > >?@ 7F57 67 =B' 5?' = @ =B' 7F ' &== 85C ' =5 @' E 7>5++ >? 7 ?A' 7F CF=+' G 7 =D=+ ?7= =?' @ 7 67 B= 7F D> D= 5G=?A 7 =7F -' =B' D =E @ ?A' F= D 75+' 566=GG=@57 =?' B= ' D5>D >BB ?A' B =G' G5++ D=H

2 ' +7F=>AF' 7F ' 7 =D=+ 75?' +>G ' =5 @' F5@' D=C ' 7=' D =E @ ' F= D 75+' 566=GG=@57 =?' B= D5>D =?+ - 7F ' B=>?@' 7 ? 567 65++ GD= I+ 7= 6=?B ? 7F ?G57 =B' 7F F= D 75+' 7=' 7F 6+5 =C ?A' 7=' E D @ G 6 CF 6F D E5 + @' 57 5?@' 5B7 7F ' 7 G CF ?' 7F B 7 F= D 75+' C5 ' =D ? @' ?' L 6' GI PQVT

2 ' ,?' PQV -' I ' 7F ' &== ' 85C' 67 =B' 7F57 5 -' D=C ' C5 ' A E ?' 7=' 7F ' 7 =^ D=+ 75?' +>G =5 @' 7= 6=?7 567 C 7F 7F +65+ 5>7F= 7 ' B= 7F 6 D7 =?' ?7=' 7F ' =5 @' ' F= D 75+ ' =B' 5?' D =?' >BB ?A' B =G' G5++ D=H' = ' =7F @5?A =>' ?B 67 =>' @ ' C 7F ?' 7F @ 7 67 -' I>7 ' C5 ' ?=' 7 >?7 + PQQ ' 7F57 HD ' D=C ' C5 ' A E ?' 7=' 7F @ +>G =5 @' I ' 7F ' &== 85C' 67 =B' 7F57 5 7=' 5@G 7 D =? ' 5 =?5I+ I + E ' 7=' I >BB ?A' B =G' G5++ D=H' CF=C ?=7 D5>D 7 C +' 7F>' I ' ?' 7F57 7F ' F= D 75+ ' =B' 7F ' +>G ' =5 @' F5E ' I ?' D 567 65++ ' 7F %' =?+ =+57 =?' F= D 75+' 5E5 +5I+ B= ' 8=?@=?- 7F=>AF' 7=' =G ' H7 ?7 7F % AFA57 ' %= D 75+' F5 E @' 7F ' 5G ' D> D=

22' ' 7> ?' G5@ ' ?' PQV ' F=C @' 7F57 5' 7F57 7 G ') 2 =>7' =B' P ' J= ' 5I=>7' PQ' D 6 ?7 ' =B' 7F ' 5? 75 ' 5>7F= 7 ' =B' (?A+5?@' 5?@' *5+ ' -' 7F ' 7F57?7F ' 7 =D=+ 75?' = ' D= 7 5? 75 ' 5 I 7F= 7 - F5@' G5@ =G D =E =?' B= ' 7F ' =+57 =?' =B' =5 =B' ?B 67 =>' @ 5 G +5' 7> ?' +57 ?A' 7=' 7F ' 6=?@ 7 =?' H 7 ?A' ?' L 6 GI PQ) F=C 7F57 I ' 7F57 7 G ' 2A2 D 6 ?7 - =B' 7F ' 5G ' 5? 75 ' 5>7F= 7 ' D ^ ?7 ?A' @ 7 67 7=A 7F $=?75 ? ?AU2) ' D ' 6 ?7 - =B' 7F ' 7=75+' ?F5I 75?7 ' F5@' =G ' D =E =?' B= ' 7F ' =+57 =?' =B' ?B 67 =>' @ 5 - 7F ' ?' F= D 75+' =B' 7F ' =C?' = ' I ' 5 5?A G ?7 C 7F ?' AFI=>' ?A' 5>7F= 7 ' - 5?@' 7F57)Ta D 6 ?7 - =B' 7F ' 5>7F= 7 ' J D ?7 ?A' @ 7 67 6=?75 ? ?A' 7=A 7F ' 2 D 6 ?7 - =B' 7F ' 7=75+' ?F5I 75?7 ' F5@' D 6 5+' 566=GG=@57 =?' B= ' G5++ D=H' D57 ?7 ' ?' 5@@ 7 =?- ' 5DD 5 ' 7F57 ' =B' 7F V D= ' 5? 75 ' 5>7F= 7 ' 7F ?' H 7 ?A' I H6+>' E ' =B' 7F ' &D ' =B' 8=?@=?' ?' (?A+5?@' 5?@' * 5+ ' F5@' 5 5?A G ?7 ' =B' =G '] ?@' B= 7F ' =+57 =?' =B' ?B 67 =>' @ 5 P) =B' 7F ' 7F ?' F5E ?A' D 6 5+' 566=GG=@57 =?' B= ' G5++ D=H' D57 ?7

2V' ' F ' E5+>' ' =B' =+57 =?' ?' 7 67 ?A' 7F ' D 5@' =B' G5++ D=H' F5 ' I ?' +=?A' 56]?=C+ @A @' I ' 7F @ 65+' BB 6 ' =B' 7F 8=65+' K=E ?G ?7 =5 @-

)TQ'

VT ' 'F ' G577 ' C5 ' B +' 7=' L ' =B ' =' G>6F' GD= 75?6 '7F57 5' (= 5+' $=GG =?' C5 '
5DD= ?7 @' 7=' 6=? @ 7F ' D E ?7 =?' 5?@ 6=?7 =+' =B ' D @ G 6 ?B 67 => ' @ 5 ?'
8=?@=?' 5?@ 7 ? AFI=> F==@
F $=GG =?:5 ' E @' 57 7F '6=?6+> =?' 7F57 ' ' /' 5DD 5 @' 6+ ' 5 + ' 75I+ F @-g' I '
7F ' HD ?6 ' =B ' 7F ' B E ' F= D 75+ ' G5 ?75 ?' @' I ' 7F +>G ' =5 @' B= G5+e B =H'
D57 ?7 -' 7F57 a I =G G 5?' = =7F 7F ' 5 +>G ' F= D 75+ ' ?' 7F D ?7 F5D
/' 65> ' 5?' 26 5 ' =B ' G5++ D=H' ?' 7F ' ?' AFI=> F==@ g' ' F ' 566= @ ?A+' ' 6=G^
G ?@ @' 7F57 7F ' F= D 75+ -' CF 6F -' ?' 7F ' >@AG ?7- F=>+@' I ' ?= +=?A ' > @' 7=
5? 7F ?A' + I 7F ' H7 ?' 7F 7F ?' C B= ' 65 =B ' G5++ D=H -' F=>+@' I 6=G - ?' 7F '
G5 ?- B E ' F= D 75+ -' 5?@ 7F57 G +@' 5?@ 6=?E5+ 6 ?7 =5 =B ' G5++ D=H F=>+@' I '
D =E @ @' B= ?' 7C = ' 7F G= 6=>?7 F= D 75+ -' 7' I ?A' 5DD5 ?7+ ' 7F=>AF7'
GD 567 65I+ ' 7=' G=E ' 56>7 ' =5 ' 7=' >6F F= D 75+

VP ' '=C5 @ ' 7F ' ?@' =B 7F ' 5 ' POQ ' 7F ' 7 =D=+ 75?' +>G ' =5 @' ' CF=' F5@'
5+ 5@ ' G5@ =G > ' =B 5 ' F= D 75+ 65GD 57 L 5 ?7F-5?@' 5 F= D 75+ ' F D ' 7F ' / 7+5 -g'
G== @' 57 K ?C 6F- ' B= ' 7F 7 57G ?7 =B G5++ D=H' D57 ?7 -' @ 6 @ @' 7=' G5]'
GD= 75?7 6F5?A ?' 7 ' G 7F=@' =B @ 5+ ?A' C 7F 8=?@=?' G5++ D=H
F / 7+5 -g F= D 75+ F D C5 ' G=E @' 7=' 8=?A 56F-' 5I=>7) F G + ' I +=C' 8=?@=?'
@A -' 5?@' C ++ C 7F=>7 7F G 7 =D=+ 75?' 5 ' 5 ' 5?@' =D ? @' ?' C I >5 ' POQ 7F '
F= D 75+ 65GD 57 L 5 ?7F C5 ' =D ? @' 5 + ' ?' 7F ' B=++=C ?A' G=?7F ' ?' :>?' =B 7F '
5G 5 ' 5 6=?@' F= D 75+ F D 7F / $5 75+ 5-g' C5 =D ? @' 5+=?A ' @ -' 7F ' / 7+5 -g'
5?@ 5' 6=?@' F= D 75+ 65GD =D ? @' 57 L 5 27F 5?@' B =G O I >5 7=' 67=I ' POQ '
7F 65 =B ' G5++ D=H' ,6 E @' I ' 7F ' =5 @' C ' @' 5+7 C 7F ' ?7F ' B=++=C ?A' G5??
5 =B ' G5++ D=H' C 6 E @' 57 B ' 5 7F ' - 5?@' 5B7 C5 @' 57 H- ?7 5 >' I5?'
F= D 75+ 5?@' 7F ' 7 57 @ [J?' 5 ' 7F ' F= D 75+ ' 57 %5GD 7 5@ 5?@' O>+F5G' F5@' I ?'
=D ? @' B= 7F ' D> D= 5?@' 5 H7F F= D 75+ F @' 57 &+5 7=C- ' > ' I =?@' 7F '
G 7 =D=+ 75?' I=>?@5 I >' ?' 5 D=D>+=> @ 7 67 [I >' 7F ' ?>GI =B ' =5 >?@'
7 57G ?7 ?' 56F ?7 5 M F5?' F= D 75+ 57 52 -' ?' 7G C5 ?=' 5++=C @' 7=' H6 @' T-
G +@' 5?@' 6=?E5+ 6 ?7 =5 I ?A' 7F 26 7 5? B @' B =G 7 G ' 7=' 7 G ' 7=' 7F D 75+
F D ' 5?@' 65GD ' CF 7F 7 57G ?7 C5 6=?7 ?> @' 5B7 7F G @@+ ' =B ' :>?' G +@'
=5 =B G5++ D=H' C ' 5+ =' 6 E @' =?' 7F ' F= D 75+ F D @ 67+ ' B =G 7F F=G
$=GD 5 ?7 -' F=C E -' 5A5 ?' 5 = ' 7F5?' =G =B 7F H ?7 5 > F5?' F= D 75+ -' 5?5 E ?'
7F57 7F ' F= D 75+ 65GD 5?' L 5 ?7F- C D 5@ ?A' G5++ D=H' ?' 7F E 6 ?7 -' + A5+'
D =6 @ ?A I ?A' ? 7 >?7 @' C 7F B ?6 ' 7=' 7F > =B 7F +577 ' ?' 5?@' B =G ' 67=I '
POQ -' 7F=>AF' 7F =5 @' 6=?7 ?> @' B= ' 5 7 G 7=' B=++=C 7F ' 5?' G 7F=@' =B @ 5+ ?A'
C 7F 5 =B G5++ D=H' I >?7F ?>GI =B 65 >?@ -' 7 57G ?7 ?' 56F ?7 5 > F5?'
F= D 75+ 57 5? ' =? ' 7 G C5 ' ?=7 5++=C @- 5 ' 5 >+ -' 7=' H6 @')

V) ' O ?5++ -' ?' :>+ ' POQ -' 7F ' 7 =D=+ 75?' +>G ' =5 @' @ 6 @ @' 7F ?6 B= C5 @'
7=' 7 57- ?' 7F ' B ' 7 ?' 75?6 -' =?' 7F ' F= D 75+ ' F D - 5++ 65 =B ' G5++ D=H' 6 E @' I '
7F =5 @' ' >?+ ' 7F 6=?@ 7 =?' =B 7F ' D57 ?7 G5@ 7F G=E5+ 7=' 7F ' F D '
@5?A => ' 5?@' 7F =5 @' ' 5 5?A ' G ?7 -' C ++ @ A? @' 5?@' C ++ 65 @' =>?- B= 7F '
6=?E ' 5?6 ' =B D57 ?7 7F 7=' F5E ?6 ' I ?' B=>?@' 7=' 5 @G 7 =B D 567 65++ ' 7F CF=+ '
=B 7F 65 I ?A' 75] ?' 7=' 7F F= D 75+ ' 5 + B 7=' 7F F= D 75+ F D ' ?' 7 G =B '
G5++ D=H' D @ G 6 -' 7F ' =5 @' 67 @' ?' PQ O -' 5?@' H7 ?@ @' ?' PQ -' 5' L 5 ?7F-
=?' 5 ' 7 ' ?' 5 7F57 I B= ' > @' B= 7F ' F= D 75+ 65GD - 5' F= D 75+ ' D G5 + ' ?7 ?@ @'
B= ' 65 ' 6=?E5+ 6 ?7 5B7 ' G5++ D=H' CF 6F C5 ' = > @' @> ?A' 7F ' +57 ' D5 7 =B 7F '
G5++ D=H =>7I 5] =B PQ) F 7 =D=+ 75?' +>G ' =5 @' F5E ' 5+ = D =E @ @-'
?6 ' POQ 5 D5 7 5+ -' 5?@' ?6 ' POQ ' 5' 6=GD+ 7 - 5GI>+5?6 ' E 6 ' B= 8=?@=?' G5++^
D=H ' 52@' =' C ++ F5 7F ' E 6 -' CF 6F B= G + ' C5 ' =B7 ?' 57 >?@=>I7 @' G 5?' =B '
?B 67 =?-' I ?' 65 @' =?' J ' 7F ' =5 @' 7F57 ' G5 - ?' 7F ' 6=?? H =?' 57 + 5' 7-' I 75] ?'
7F57 ?=' D 5@' =B ?B 67 =?' F5 ' =66> @' B =G' 7F =5 @' ' 5GI>+5?6

V ' ?' G5? ' =B 7F ' +5 A ' 7=C? ' =B' (?A+5?@' 7F ' ?=7 B 657 =?' =B' ?B 67 => ' @ ' 5 -'
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6 E @-' 5?@' ?@ 5E=> ' G5@ ' C 7F G= ' ' E 4=> ' 7=' =+57 ' 65 =B 7F @' 5 '
I G=E ?A' 7F G 7=' 5 F= D 75+ ' F5++' 5@E 7 D ?7+ 7=' 7F ' BB 67 =B 7F '
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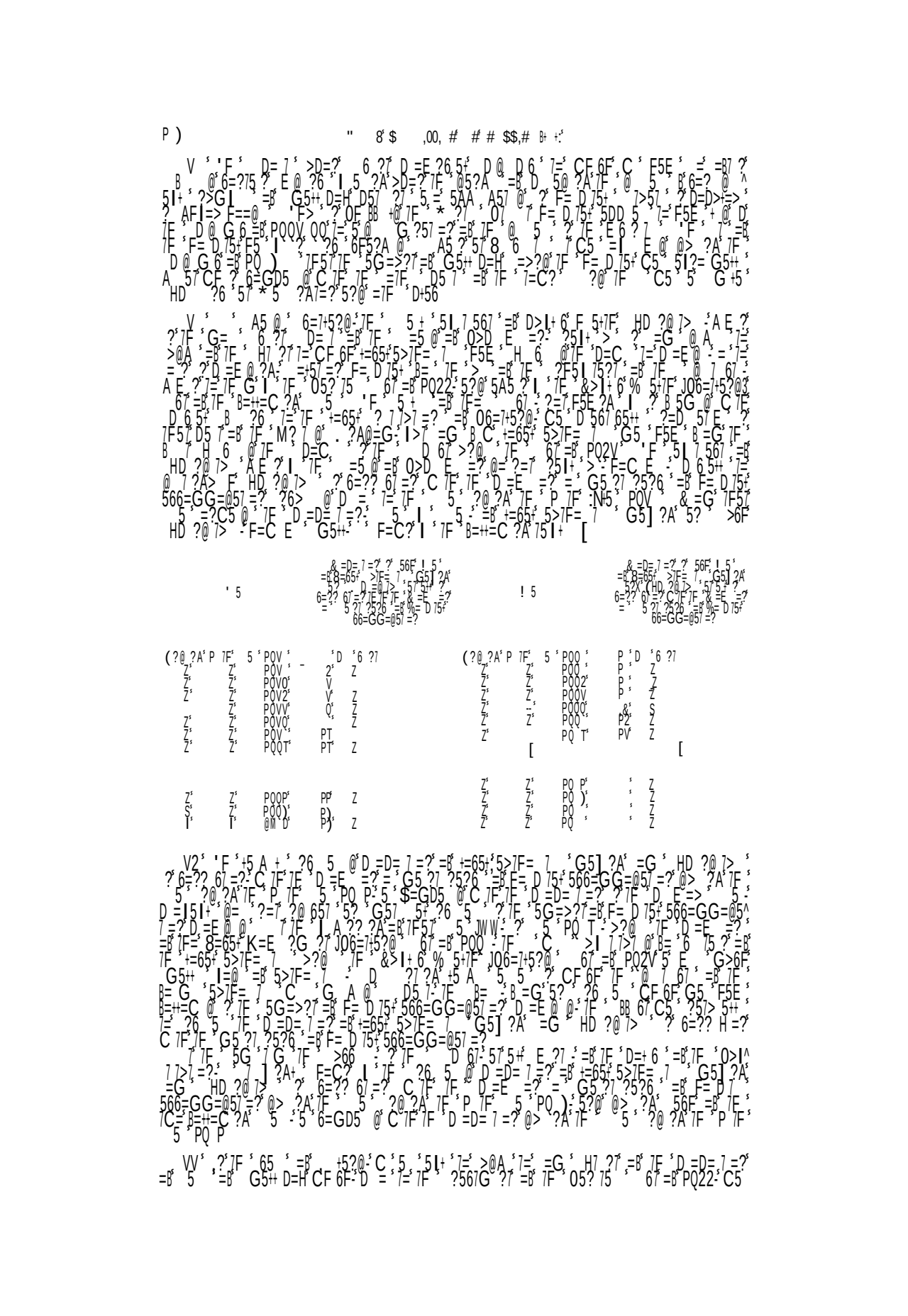
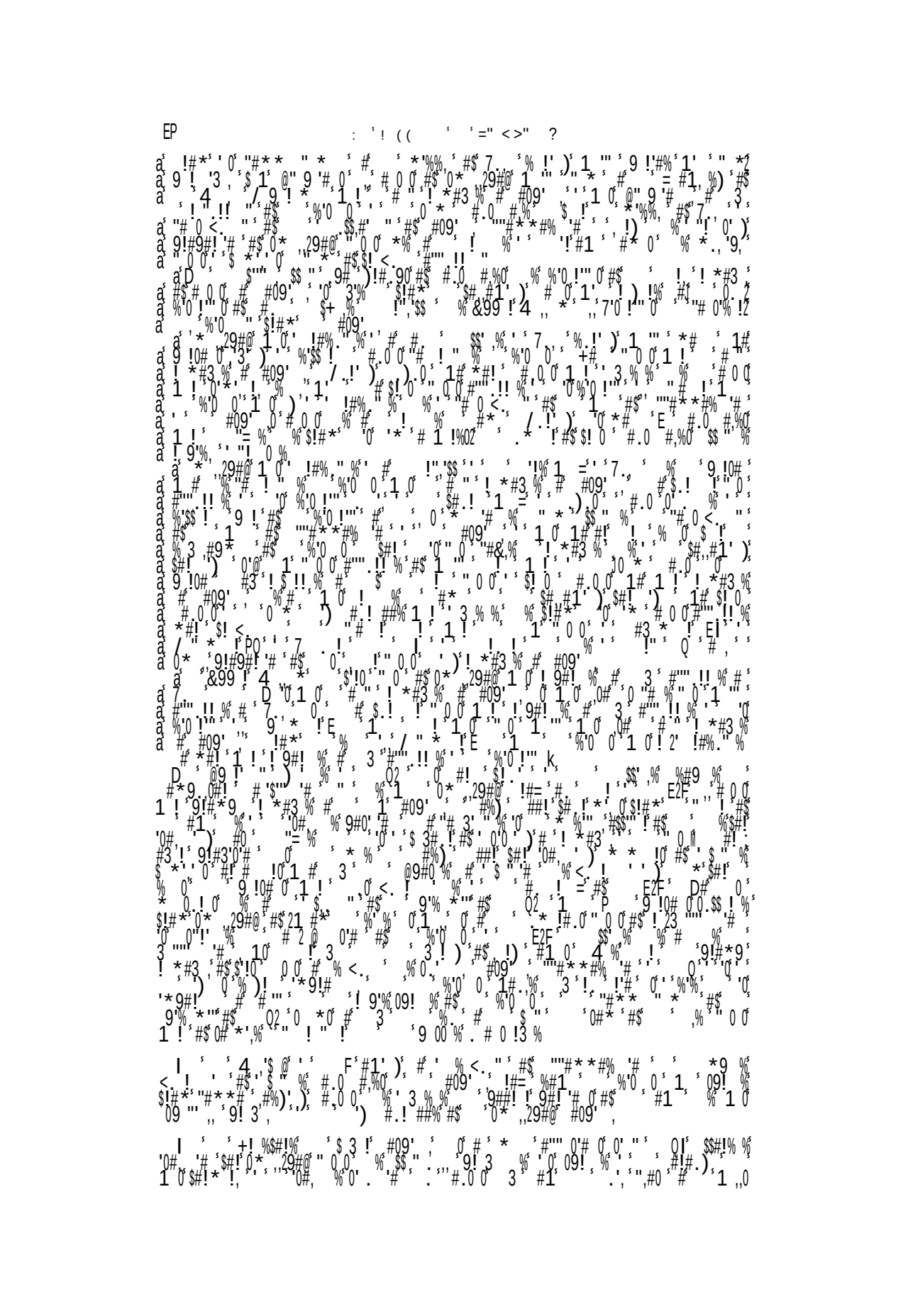
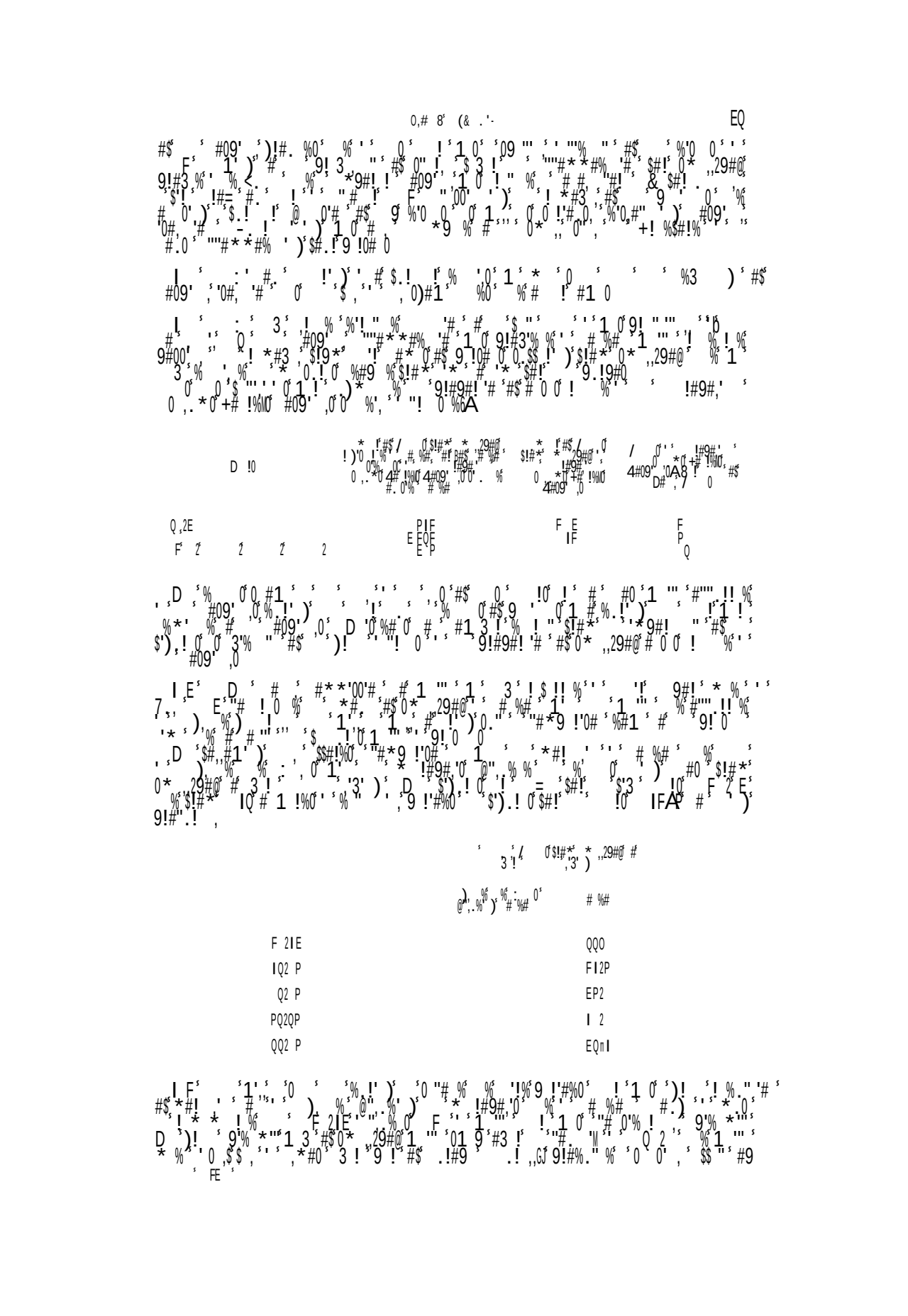
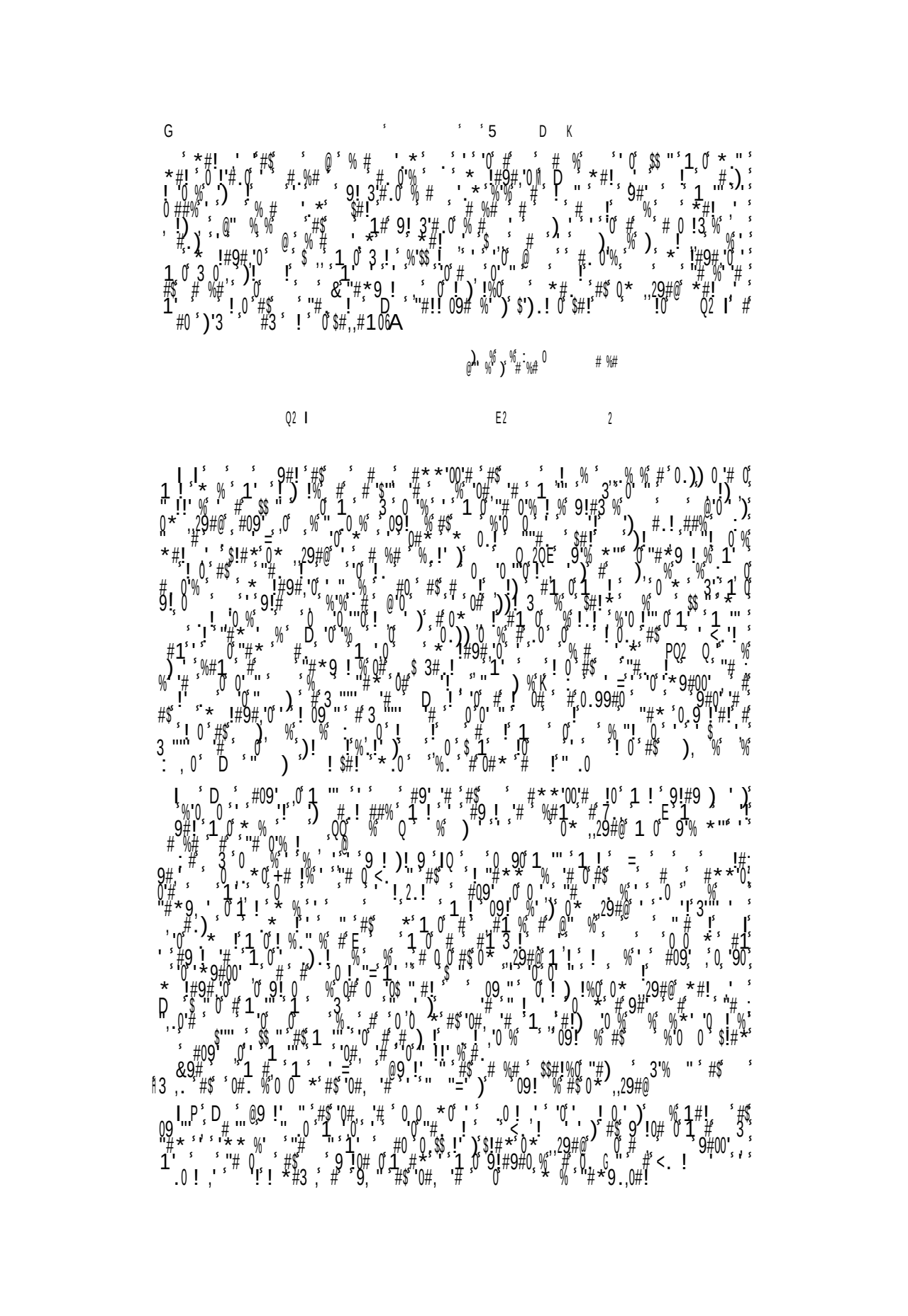
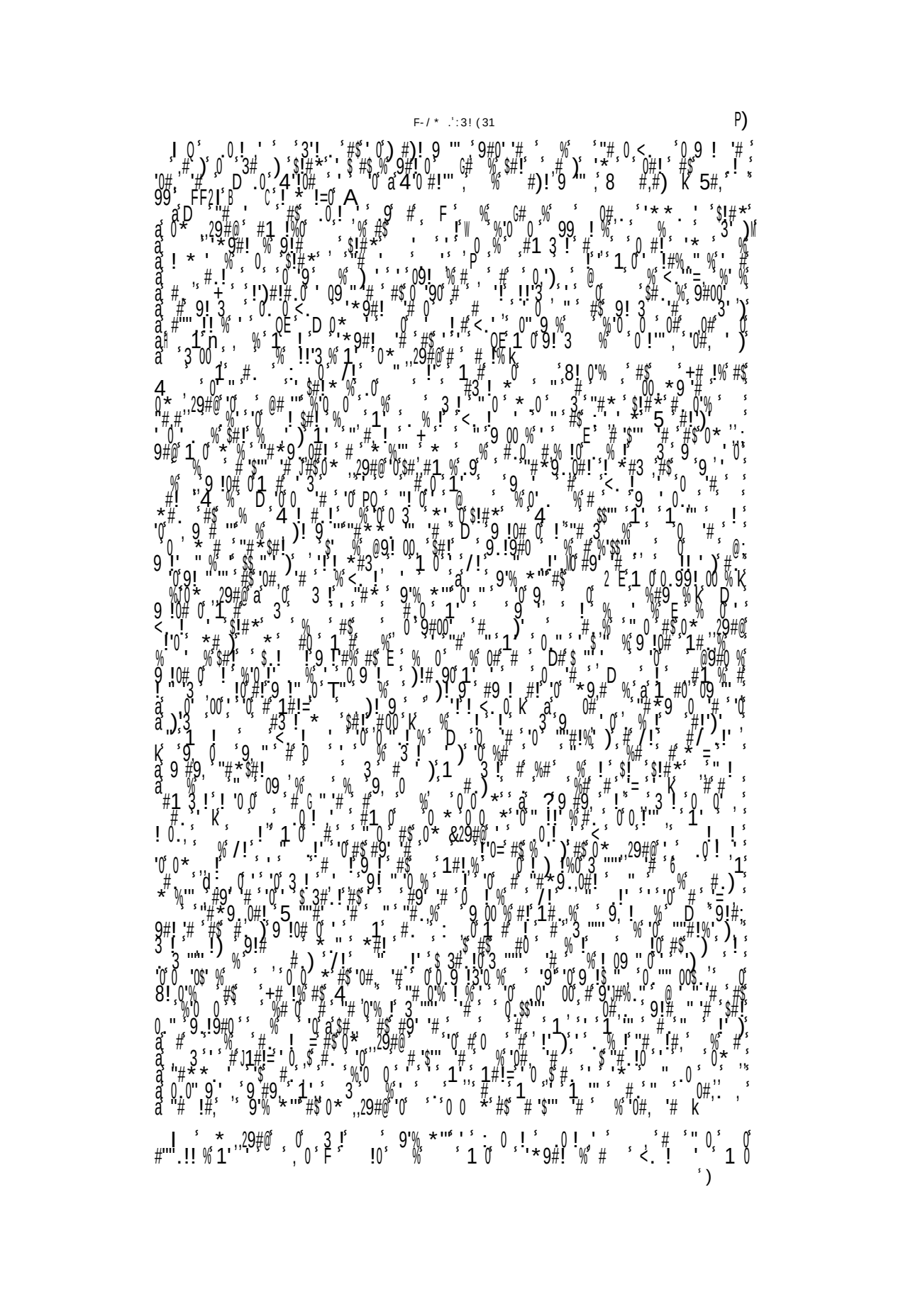


7 57 @ ? F= D 75+ = 2B G5 =B =G = 7 'F ?\> 7 CF 6F C F5E 5+ 5@ B @- G5@ =? 7F 75] ?A =B 7F 6 ? > PQ P- PQ P- ? PQ2P- 5?@ ? PQVP A5E 7F B=++=C ?A >+7 [d ? > D= 7 =B O> A =? * +@ : " D= 7 ? PQ P- D5 7 E =+ + H- 5?@+H- 5?@ DD PQ) 5?@ P) T









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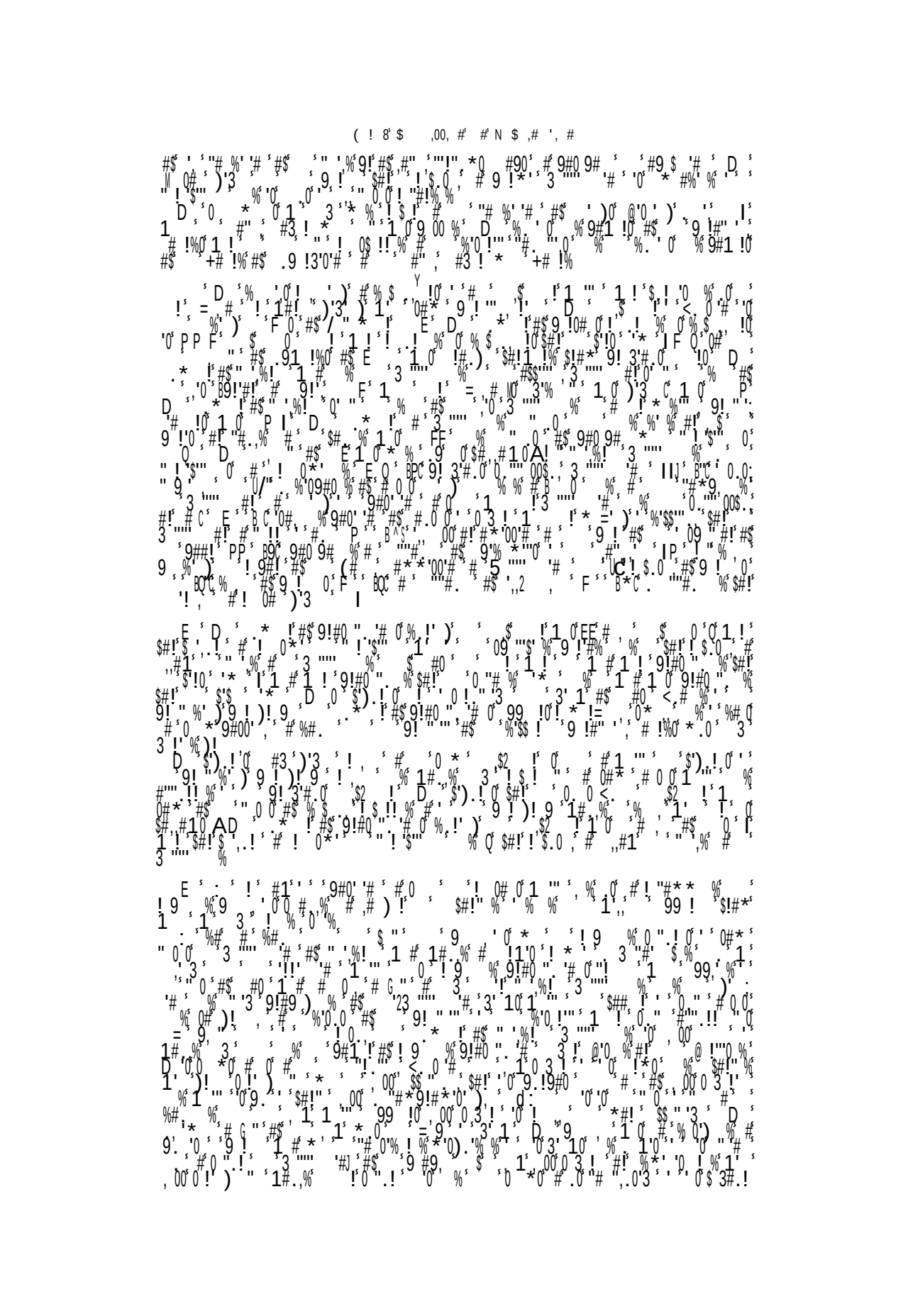

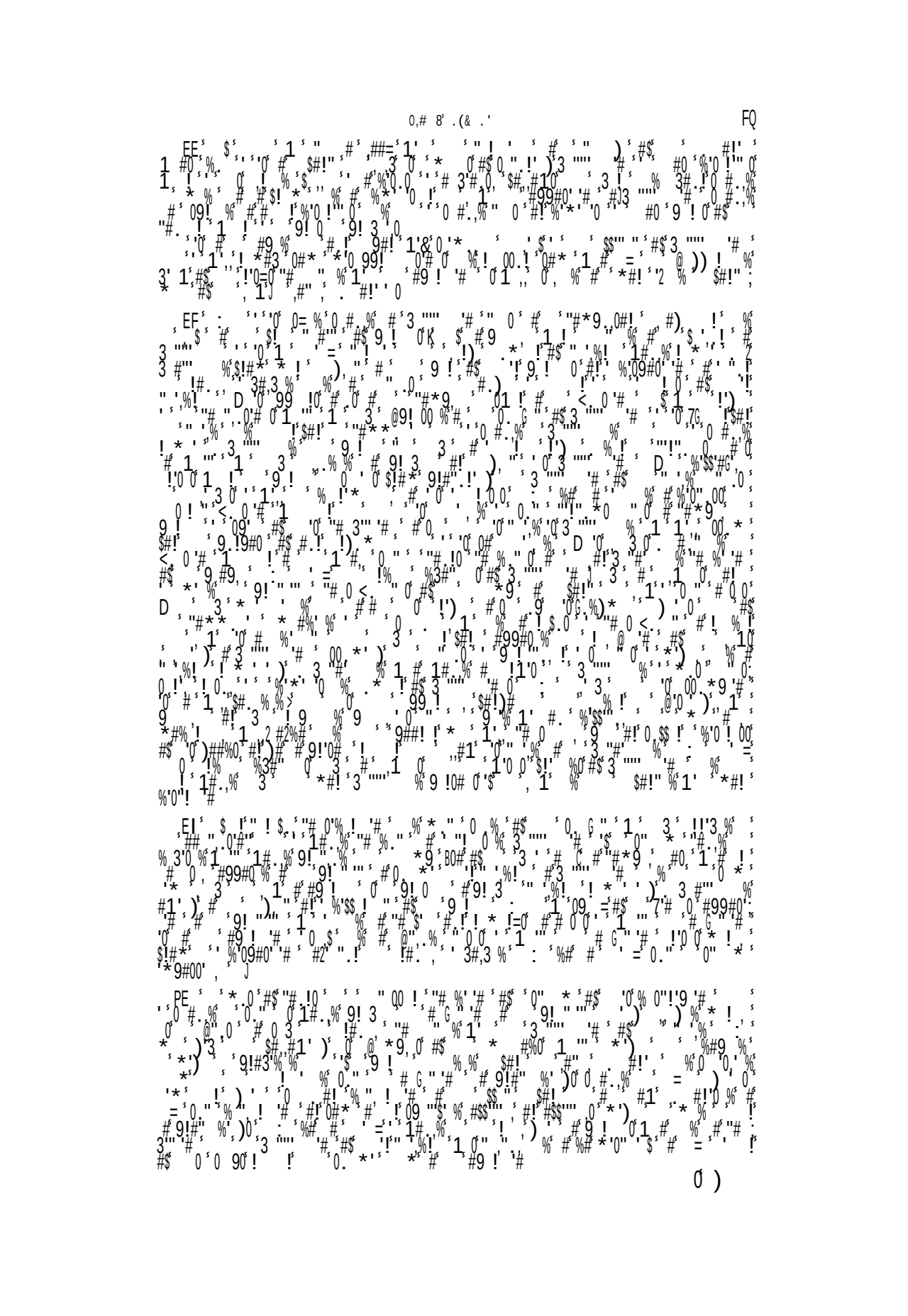

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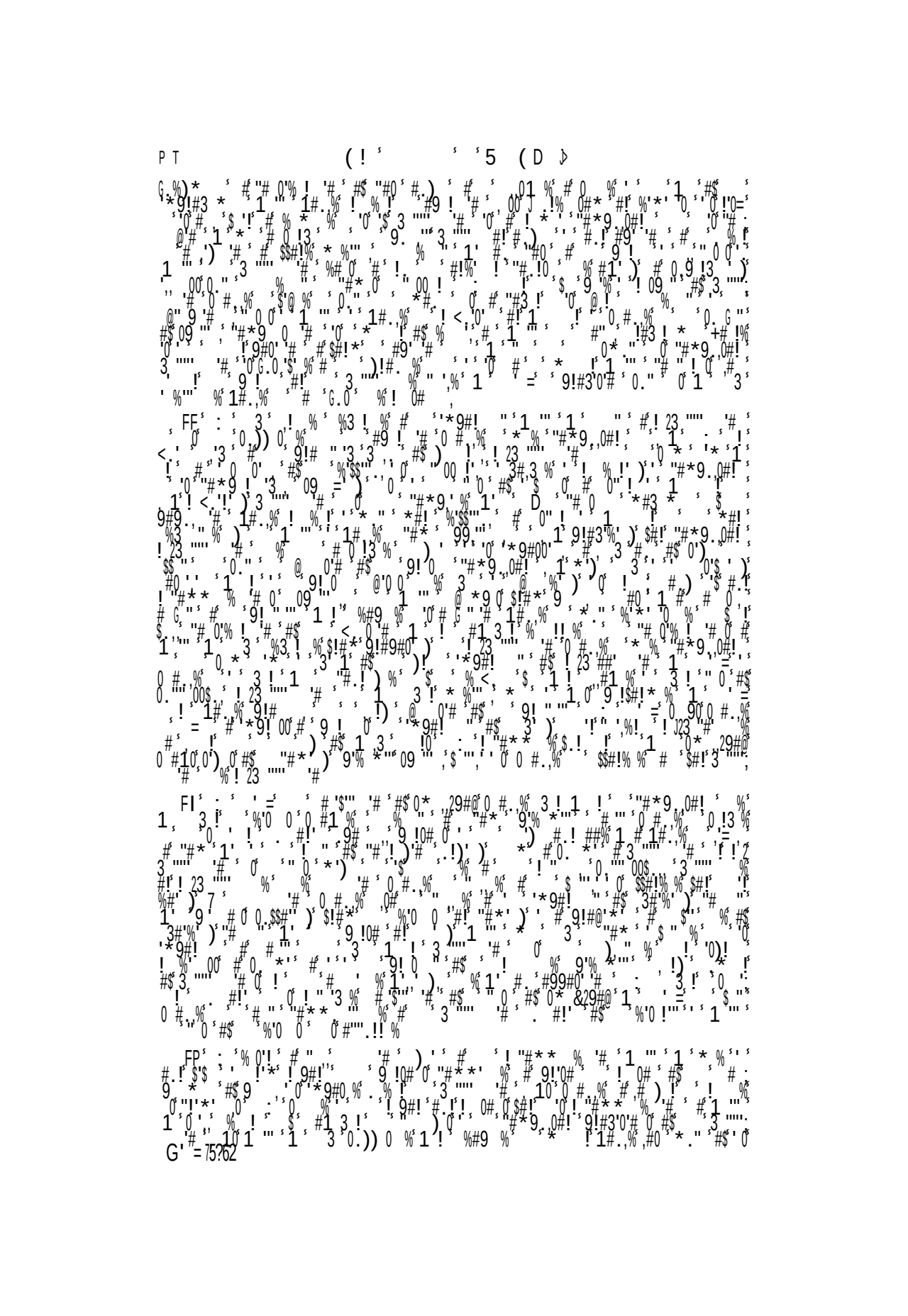

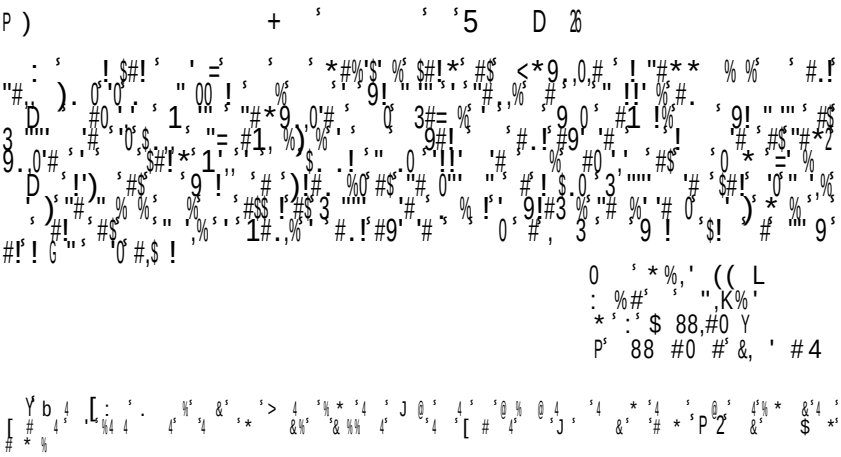

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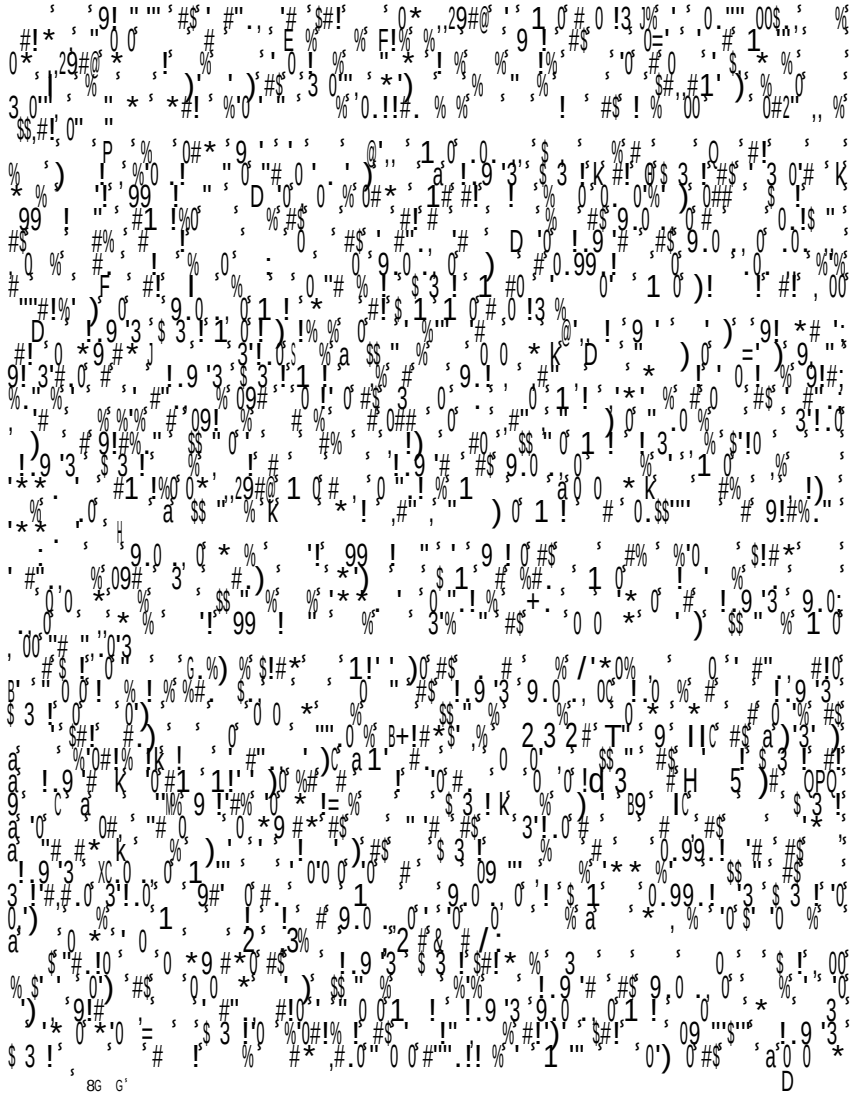

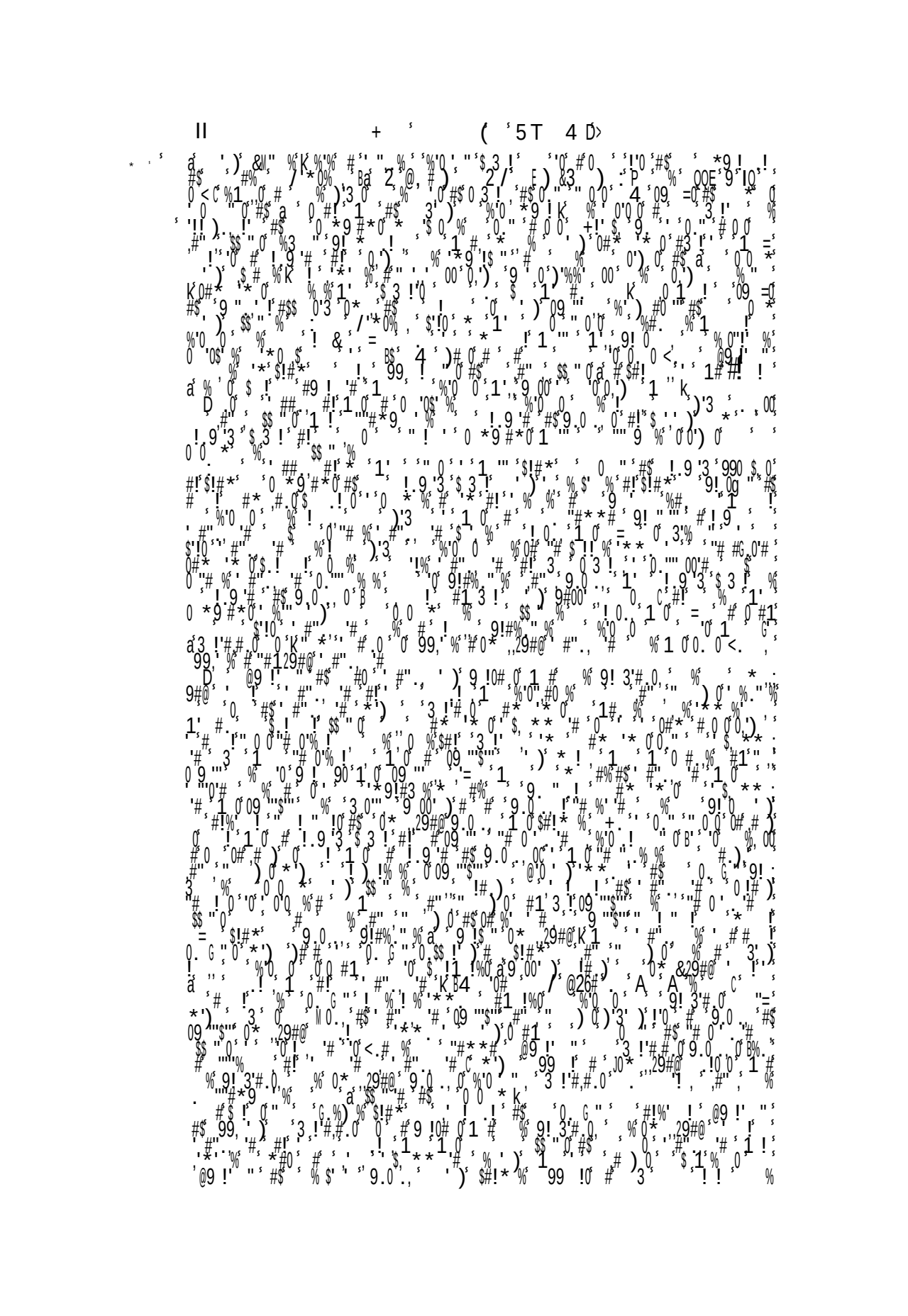

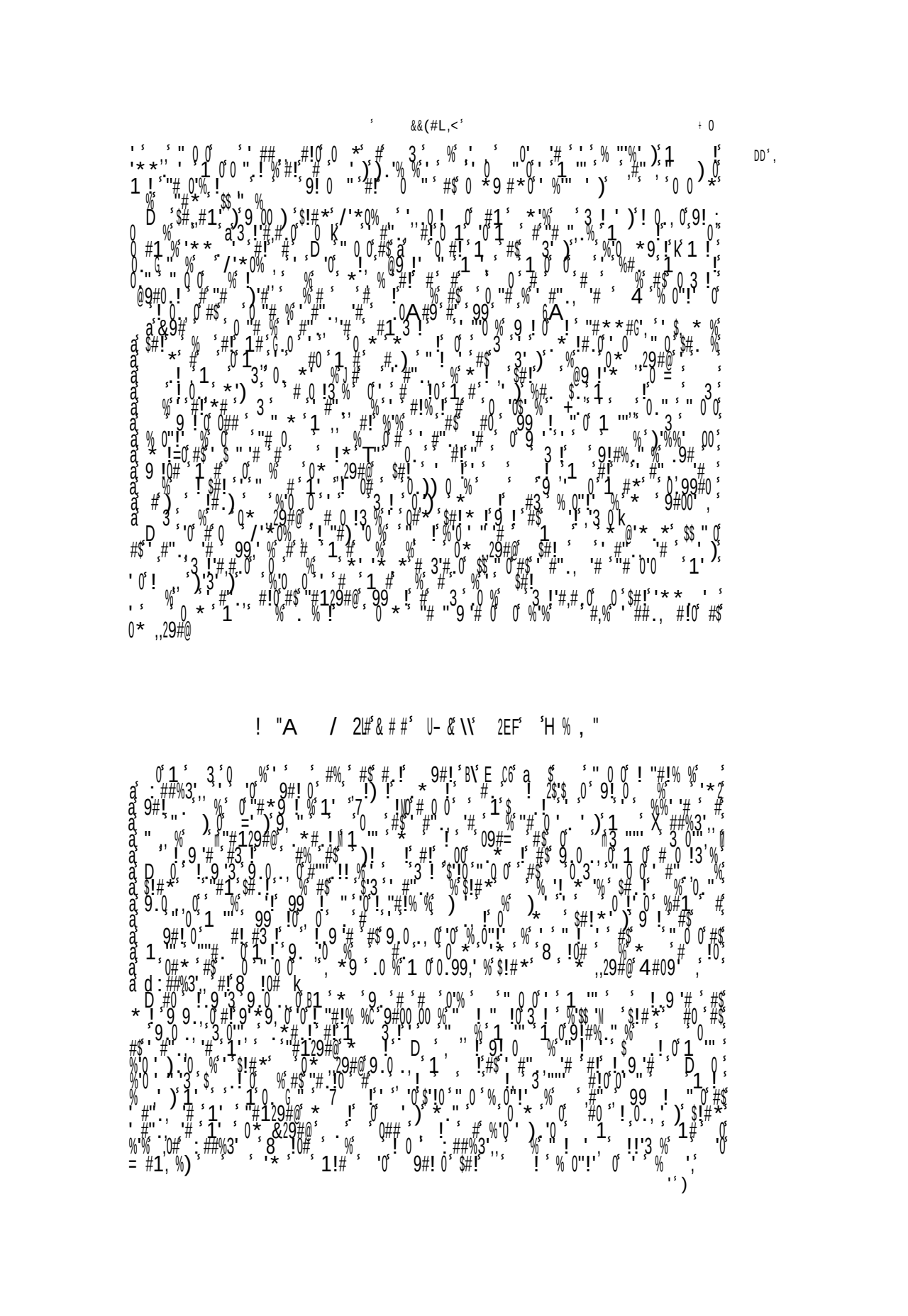

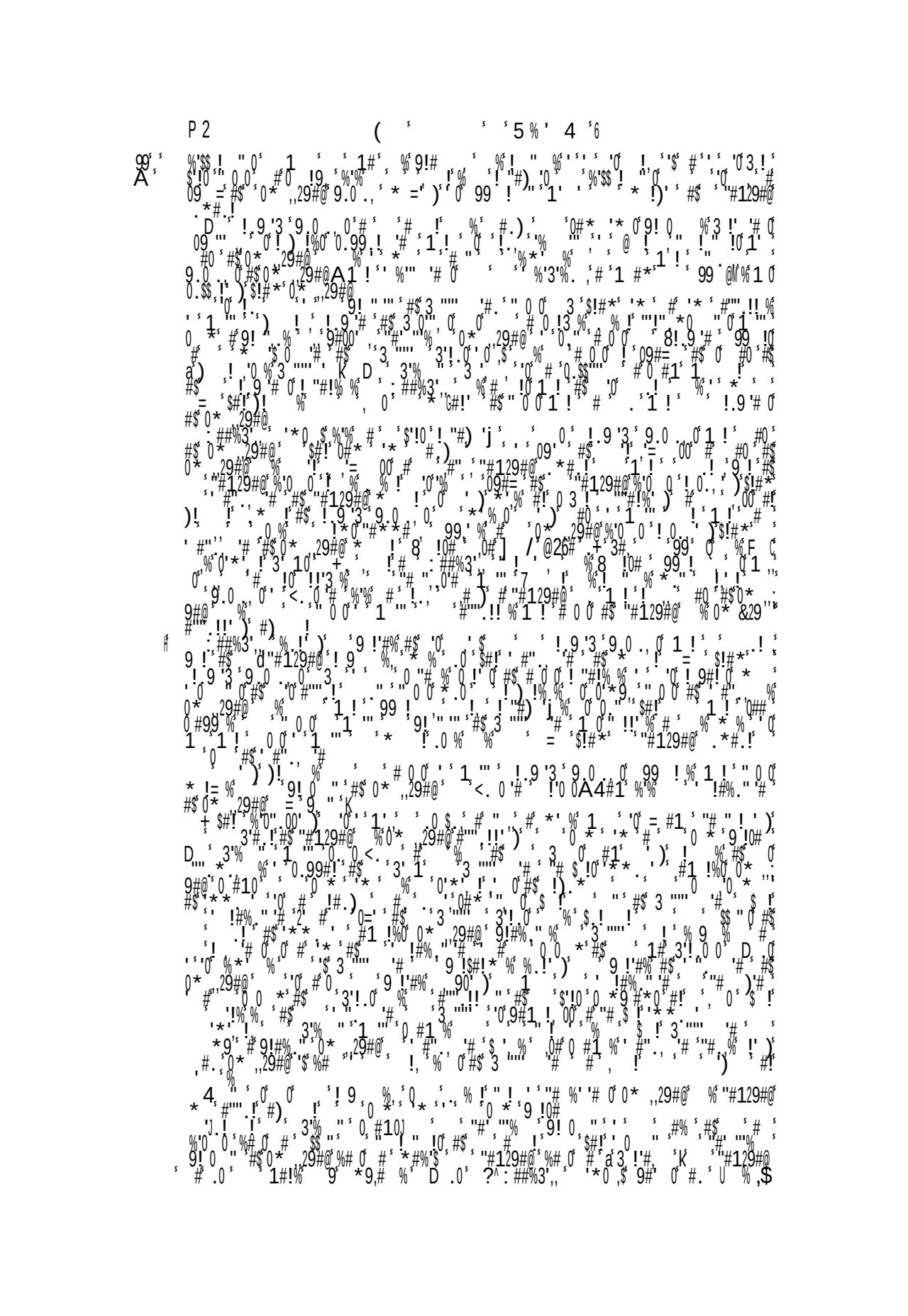

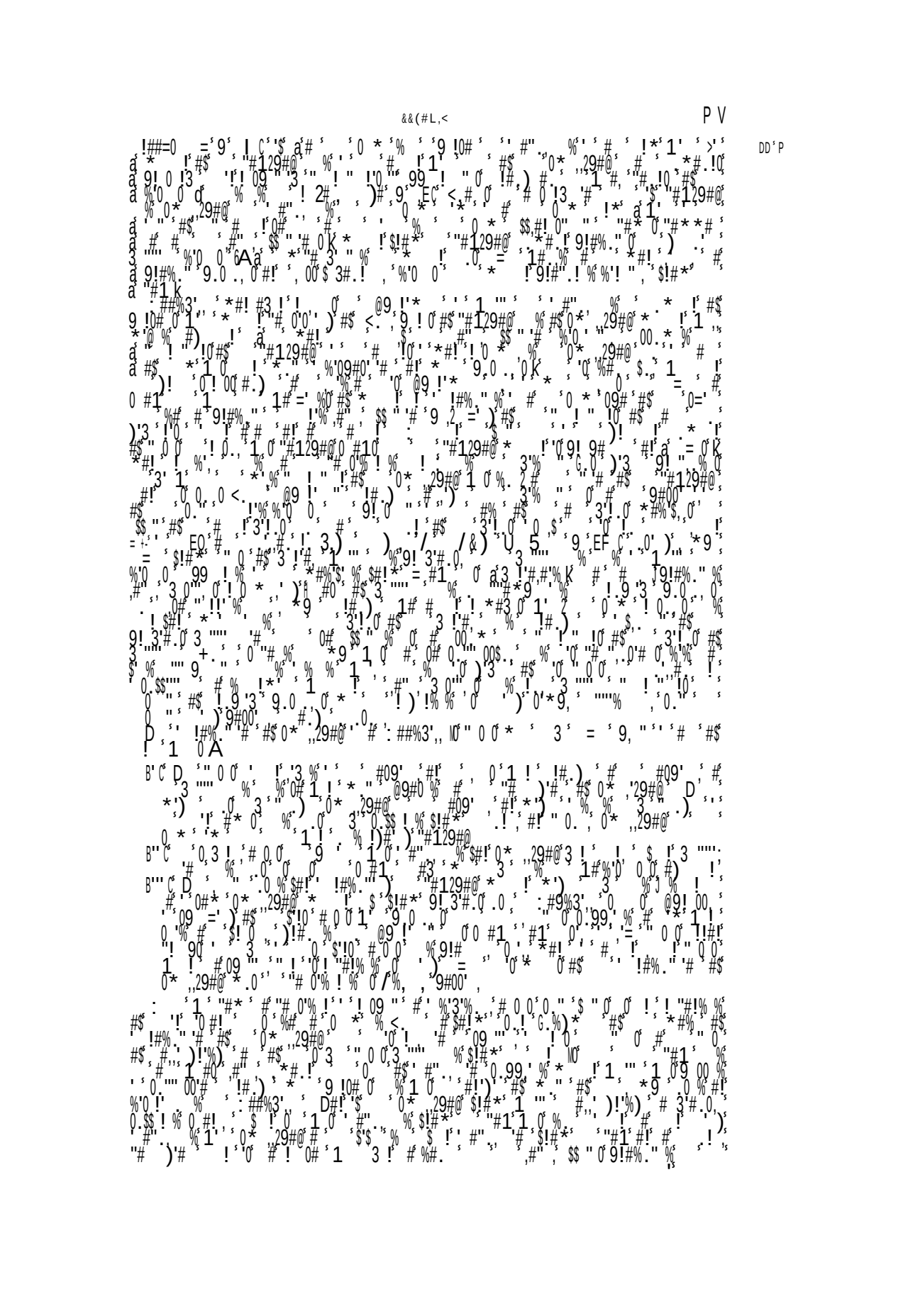

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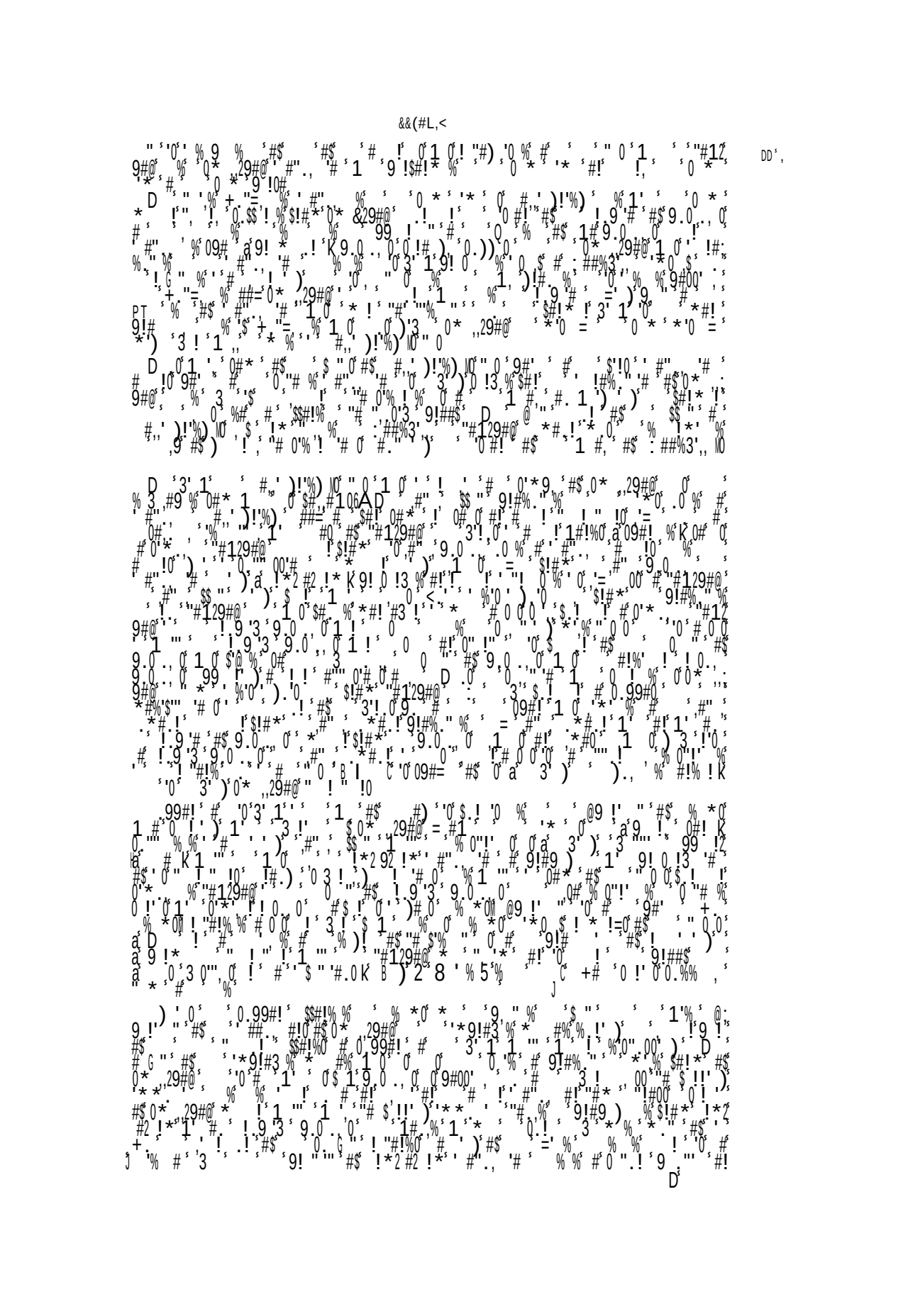

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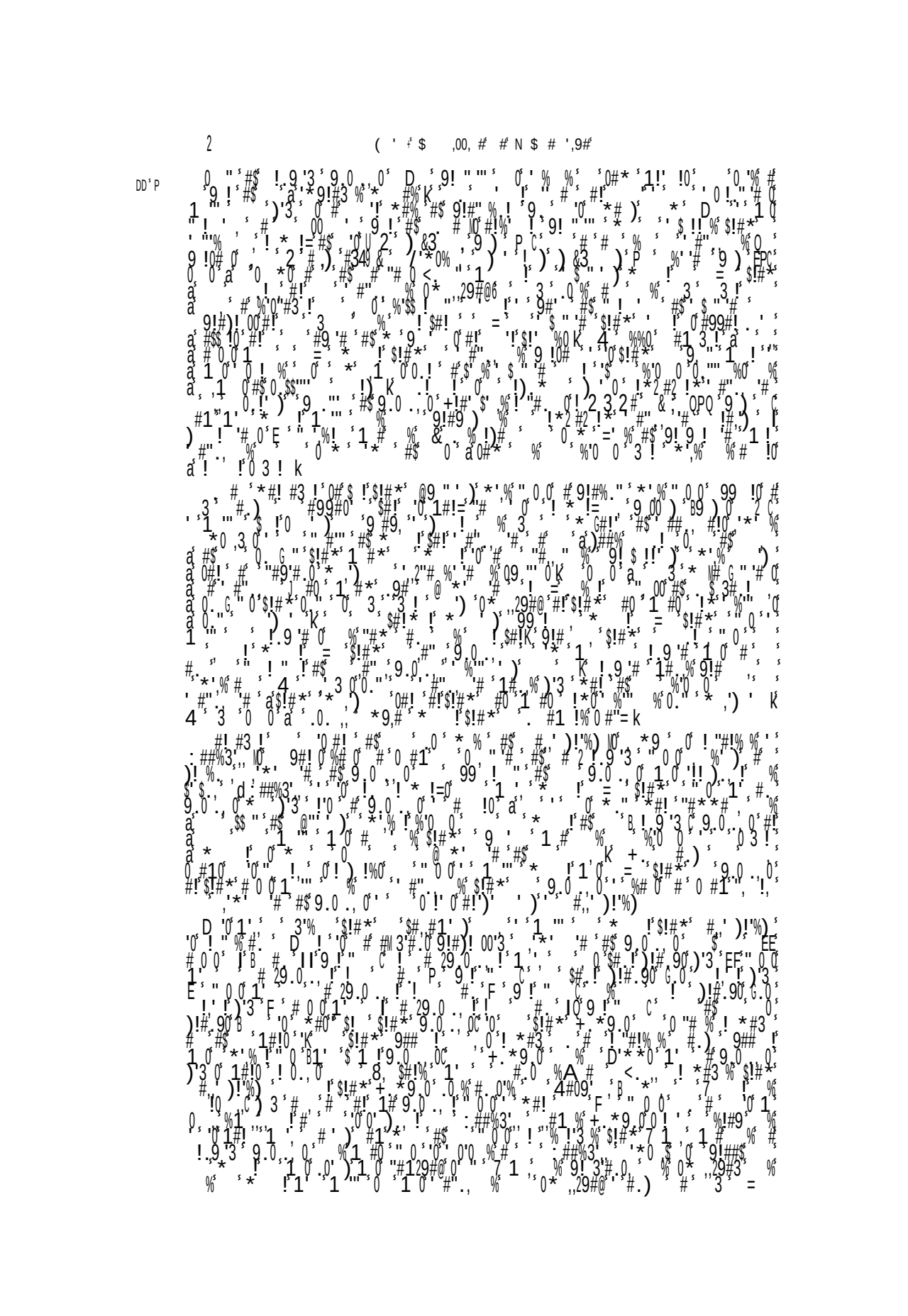


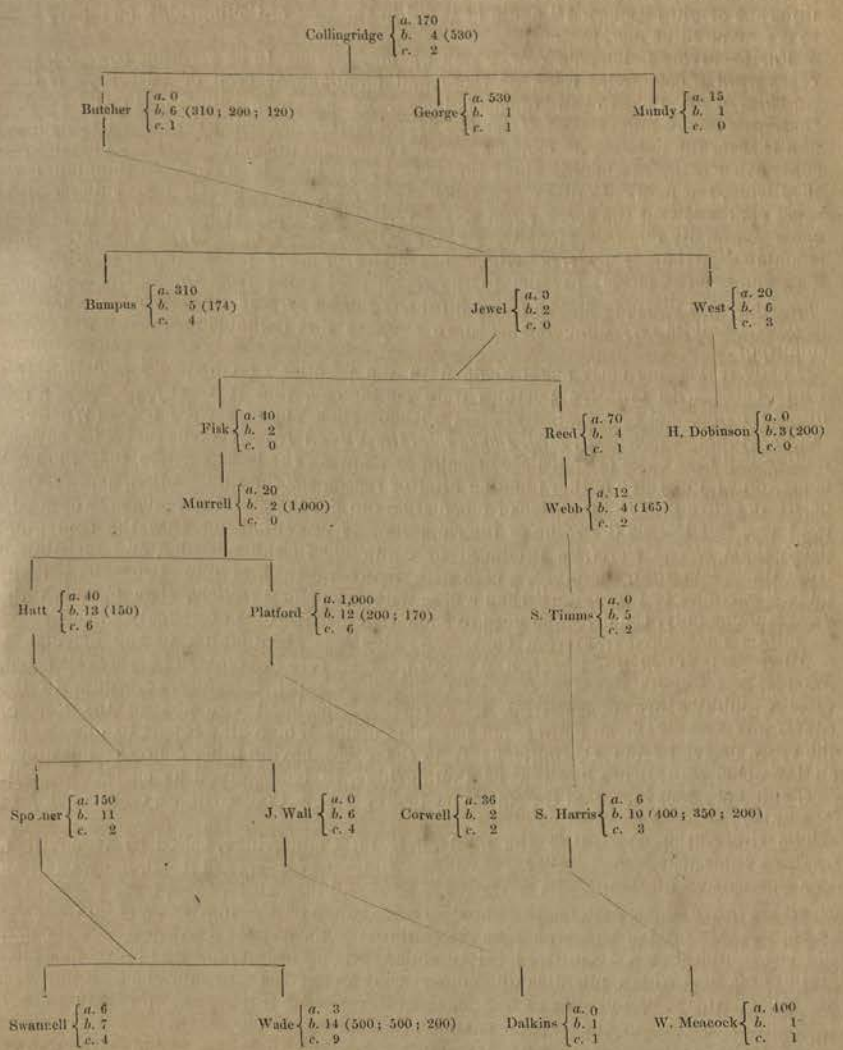
App. 1.

The figures against the names in the table below indicate:—

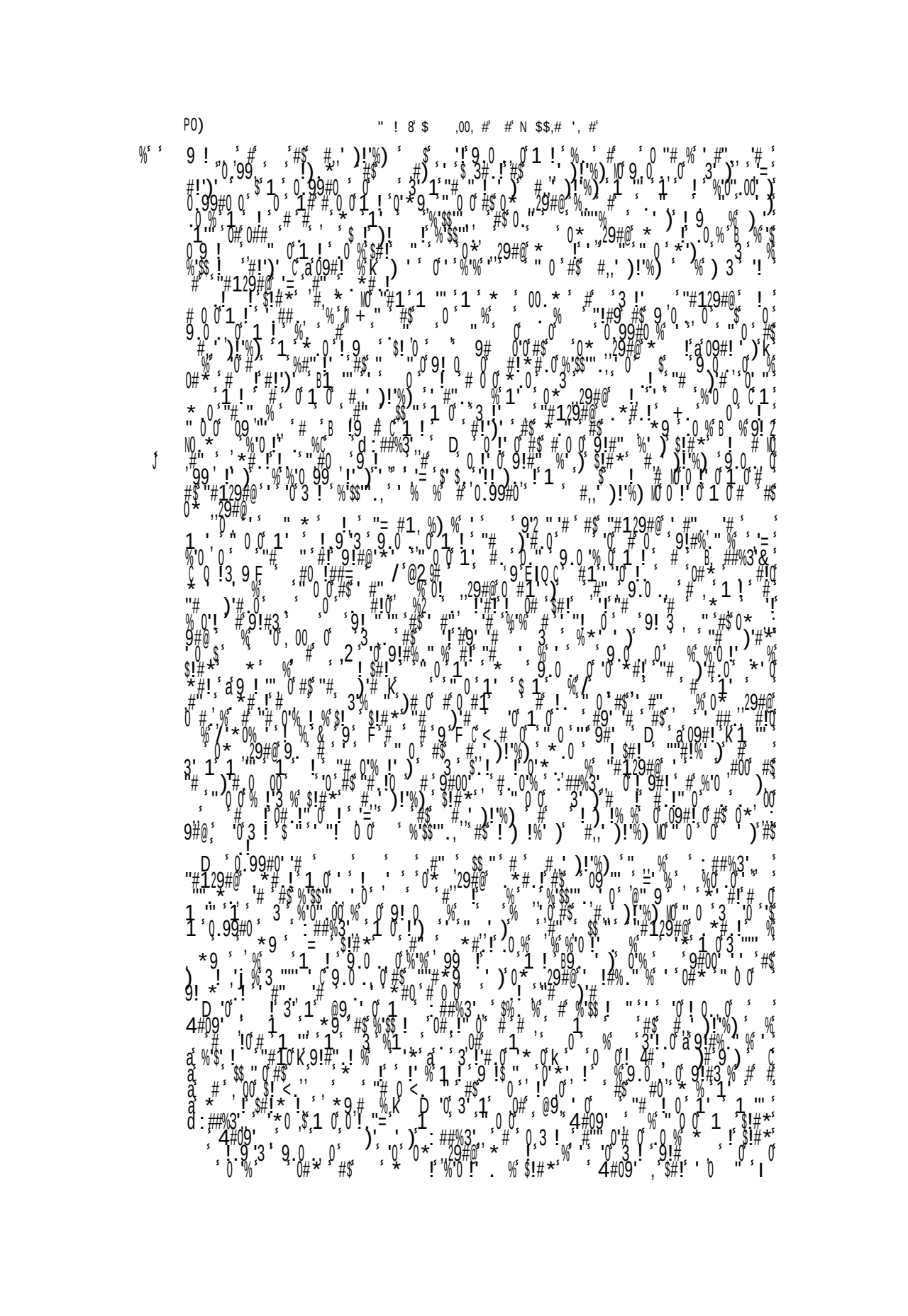
a.—The number of pustules appearing in the case itself.

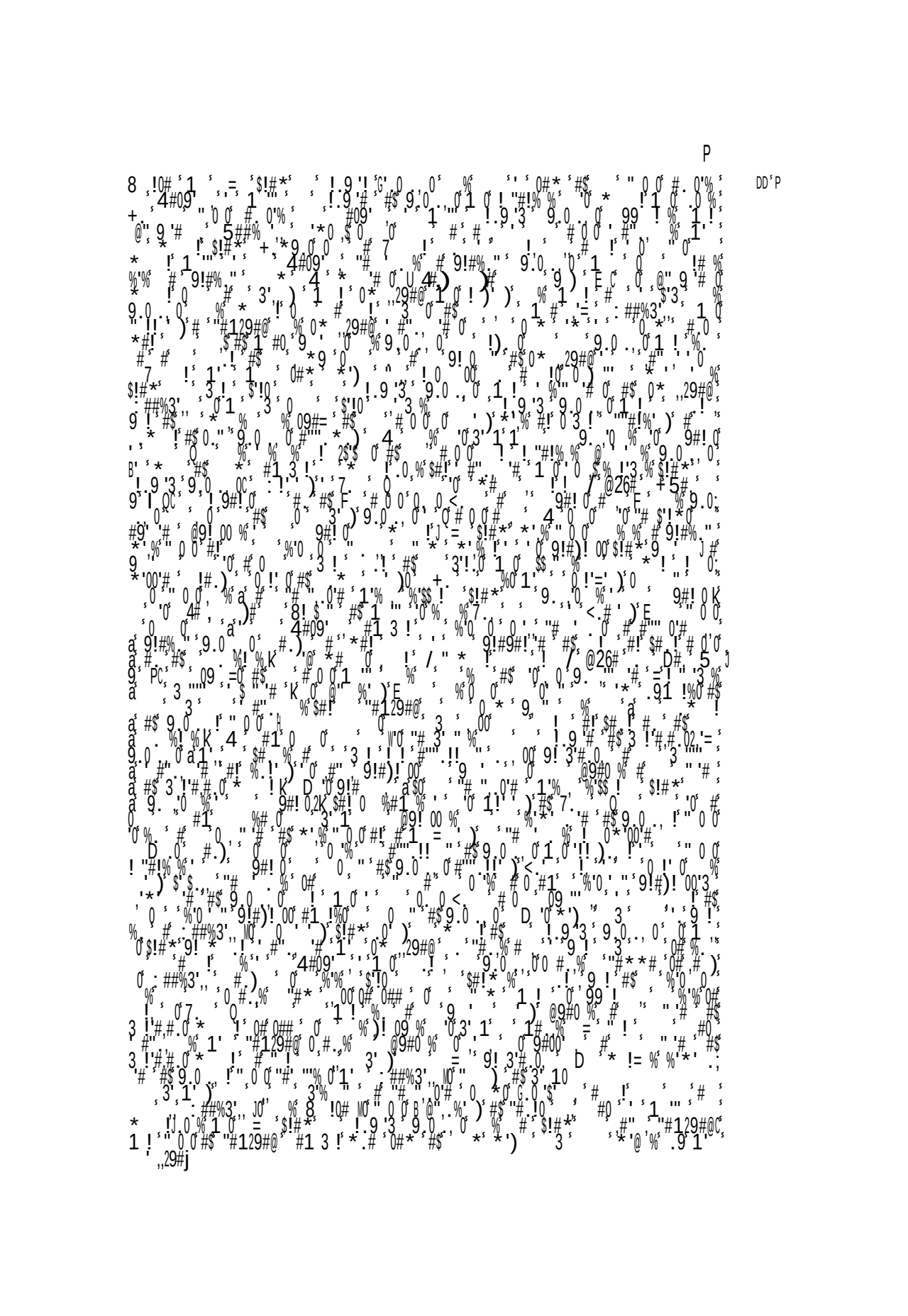
b.—The number of cases done from the tumour on the arm of the case. (The figures in brackets giving the number of pustules, in the cases so done, in the instances where they exceeded one hundred.)

c.—The number of the above cases in which pustules were absent.


Collingridge a. 170 b. 4 (330) c. 2
Butcher a. 0 b. 6 (310; 200; 120) c. 1
George a. 530 b. 1 c. 1
Mundy a. 15 b. 1 c. 0
Bumpus a. 310 b. 5 (174) c. 4
Jewel a. 3 b. 2 c. 0
West a. 20 b. 6 c. 3
Fisk a. 40 b. 2 c. 0
Reed a. 70 b. 4 c. 1
H. Dobinson a. 0 b. 3 (200) c. 0
Murrell a. 20 b. 2 (1,000) c. 0
Webb a. 12 b. 4 (165) c. 2
Hatt a. 40 b. 13 (150) c. 6
Platford a. 1,000 b. 12 (200; 170) c. 6
S. Timms a. 0 b. 5 c. 2
Spooner a. 150 b. 11 c. 2
J. Wall a. 0 b. 6 c. 4
Corwell a. 36 b. 2 c. 2
S. Harris a. 6 b. 10 (400; 350; 200) c. 3
Swannell a. 6 b. 7 c. 4
Wade a. 3 b. 14 (500; 500; 200) c. 9
Dalkins a. 0 b. 1 c. 1
W. Meacock a. 400 b. 1 c. 1

Further, while Collingridge's local tumour was the source of much of the lymph used or distributed by Woodville, it was not the only source. From the sores of the dairy-maid at the Gray's Inn Lane "dairy" five cases were inoculated. One of these (Crouch) had no eruptive pustules, and matter taken from his arm produced cow-pox in a cow belonging to Mr. Coleman; we may conclude that Crouch's case was one of veritable cow-pox. But Harris and Bunker, done on the same day, and with the same matter had eruptive pustules, the former 300, the latter only 3. These two cases, being inoculated for small-pox on the fifth day of the inoculation with cow-pox matter, are





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PQ2	)	)V)	PT)	P	P	P2	2
PQ22	)))	)T		)	P 2	P 2	
PQ2V	)	) Q	Q2	P	P	P2T	
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PQV	P)		P Q	2)	))	) Q	QV
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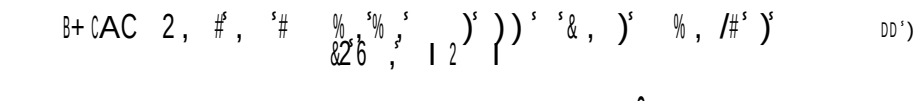

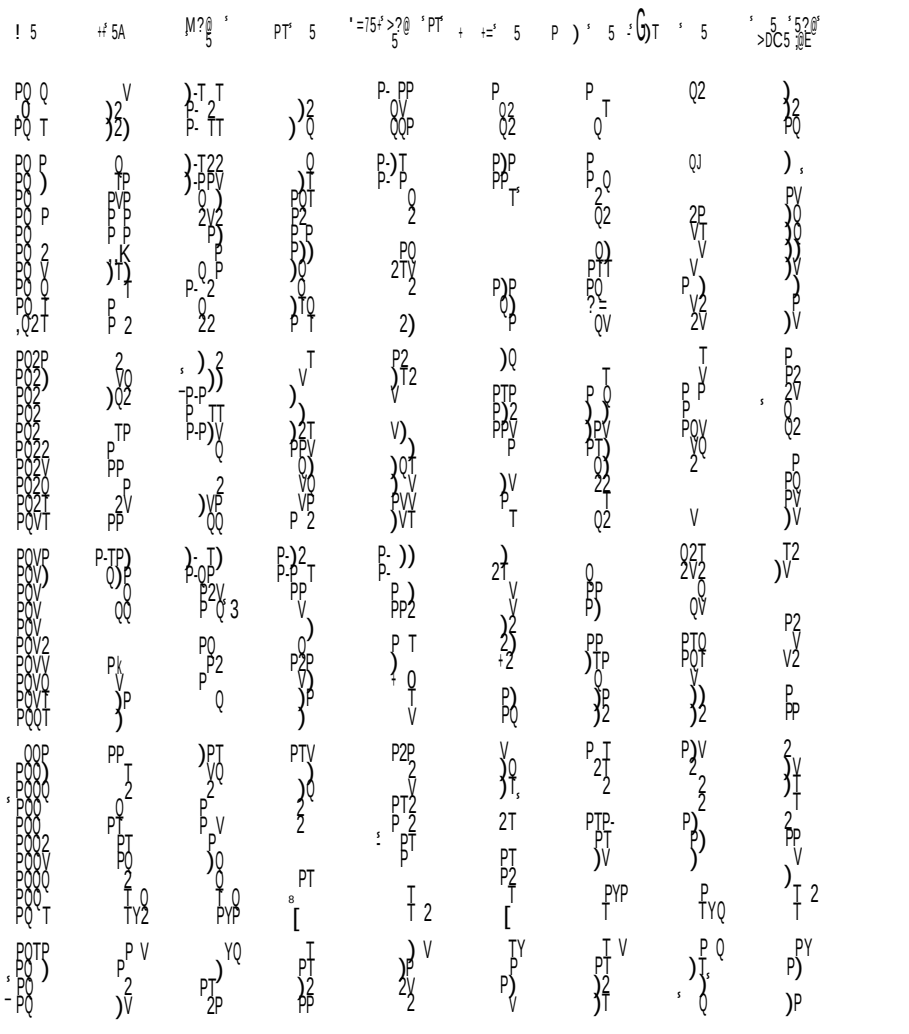

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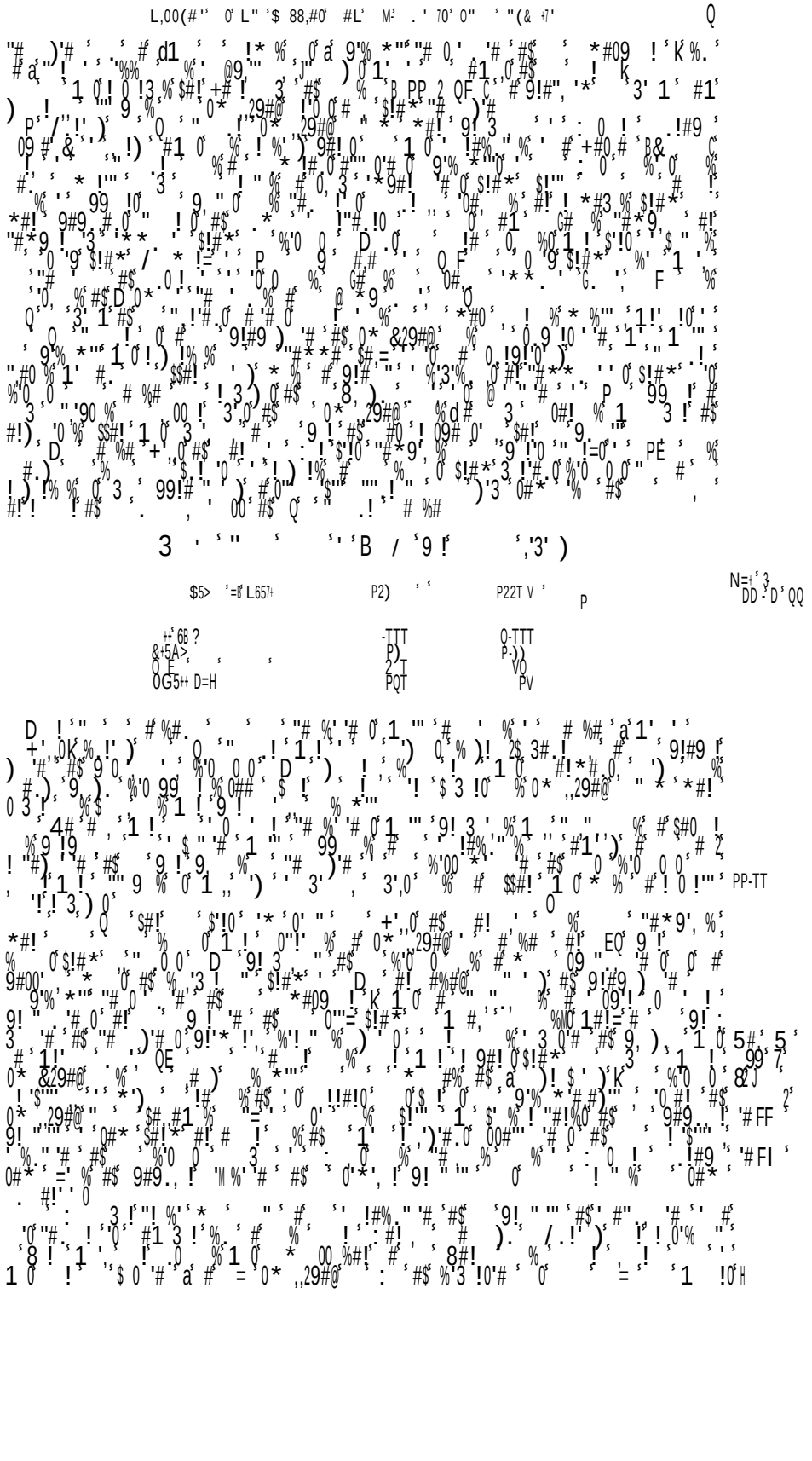

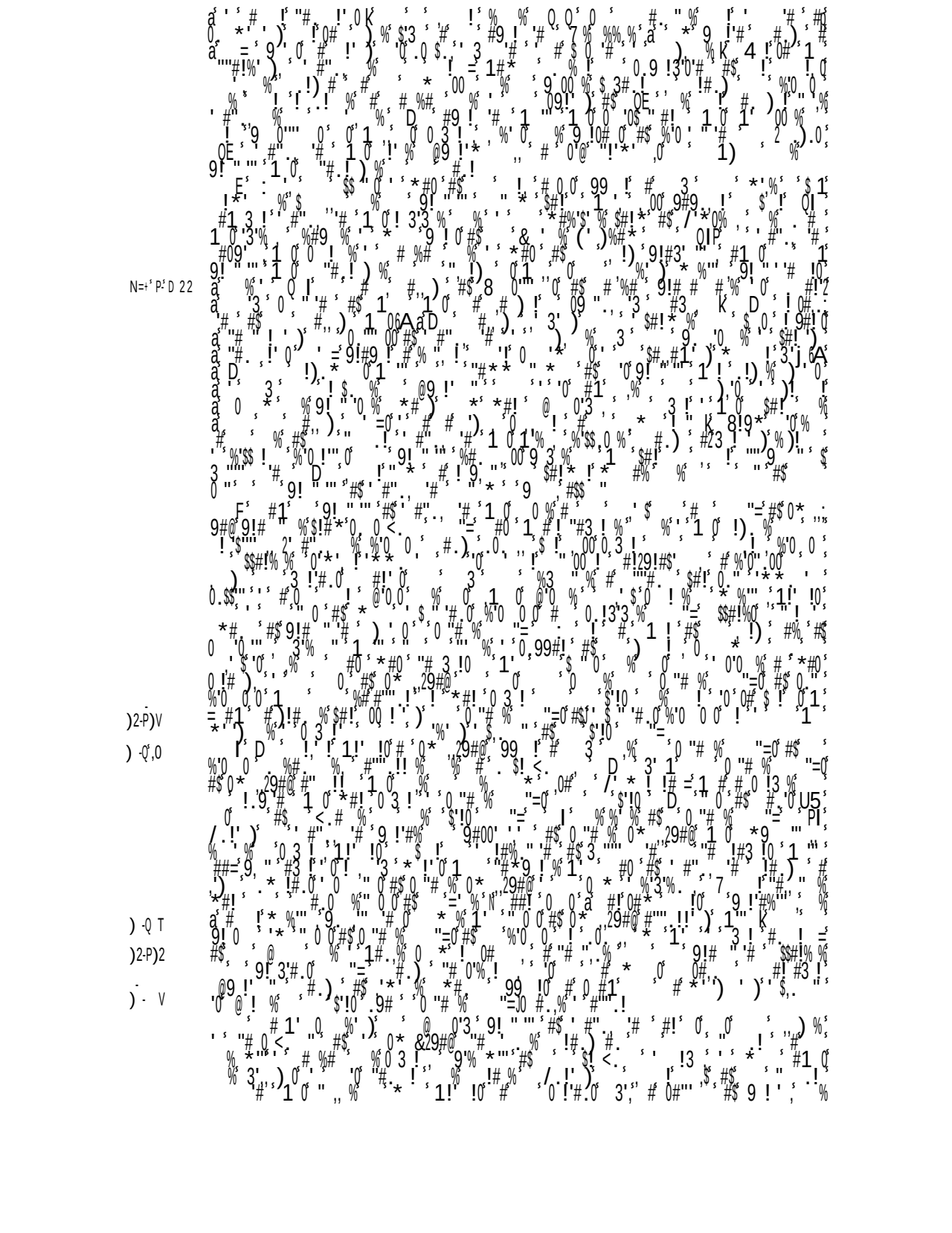

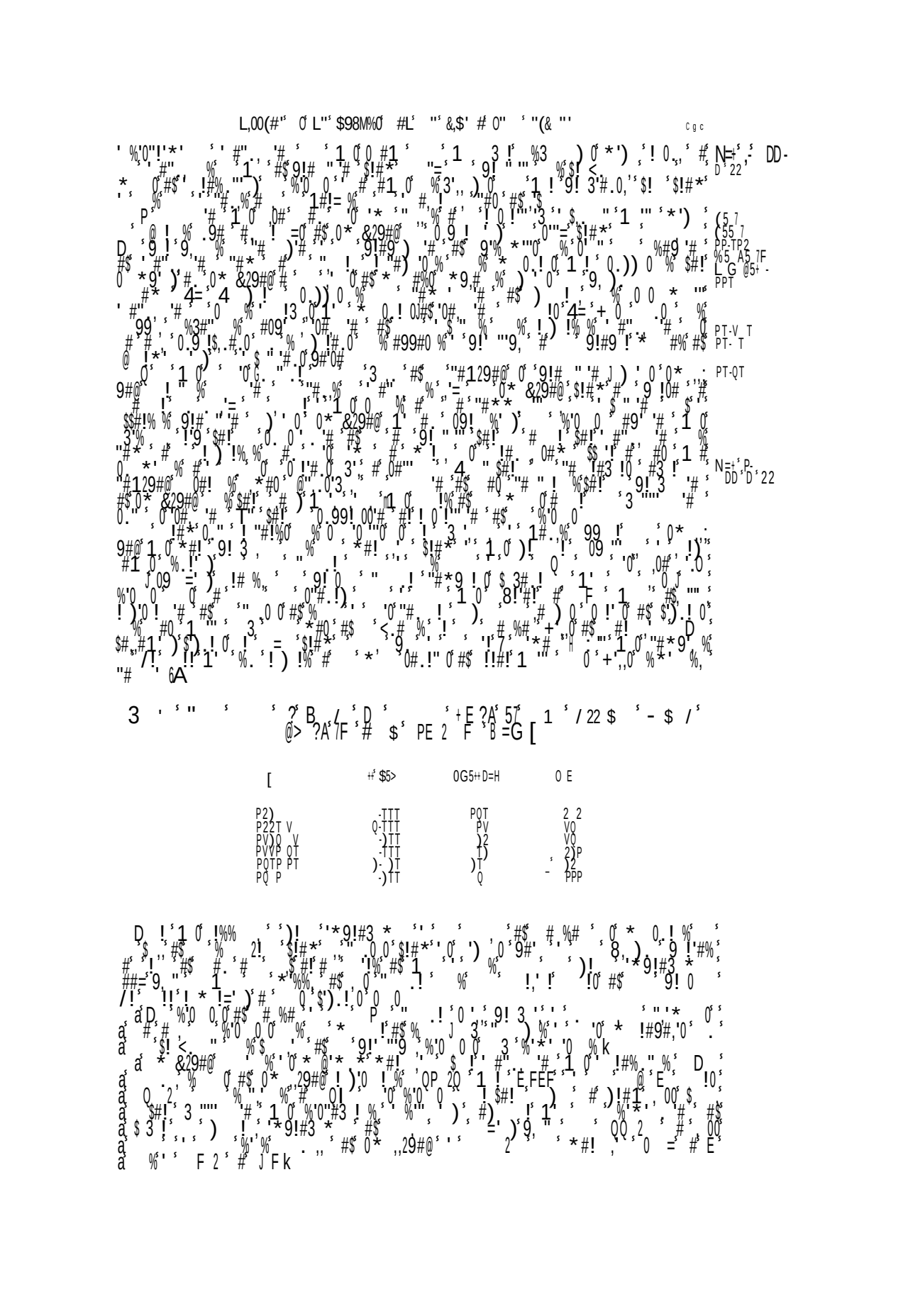

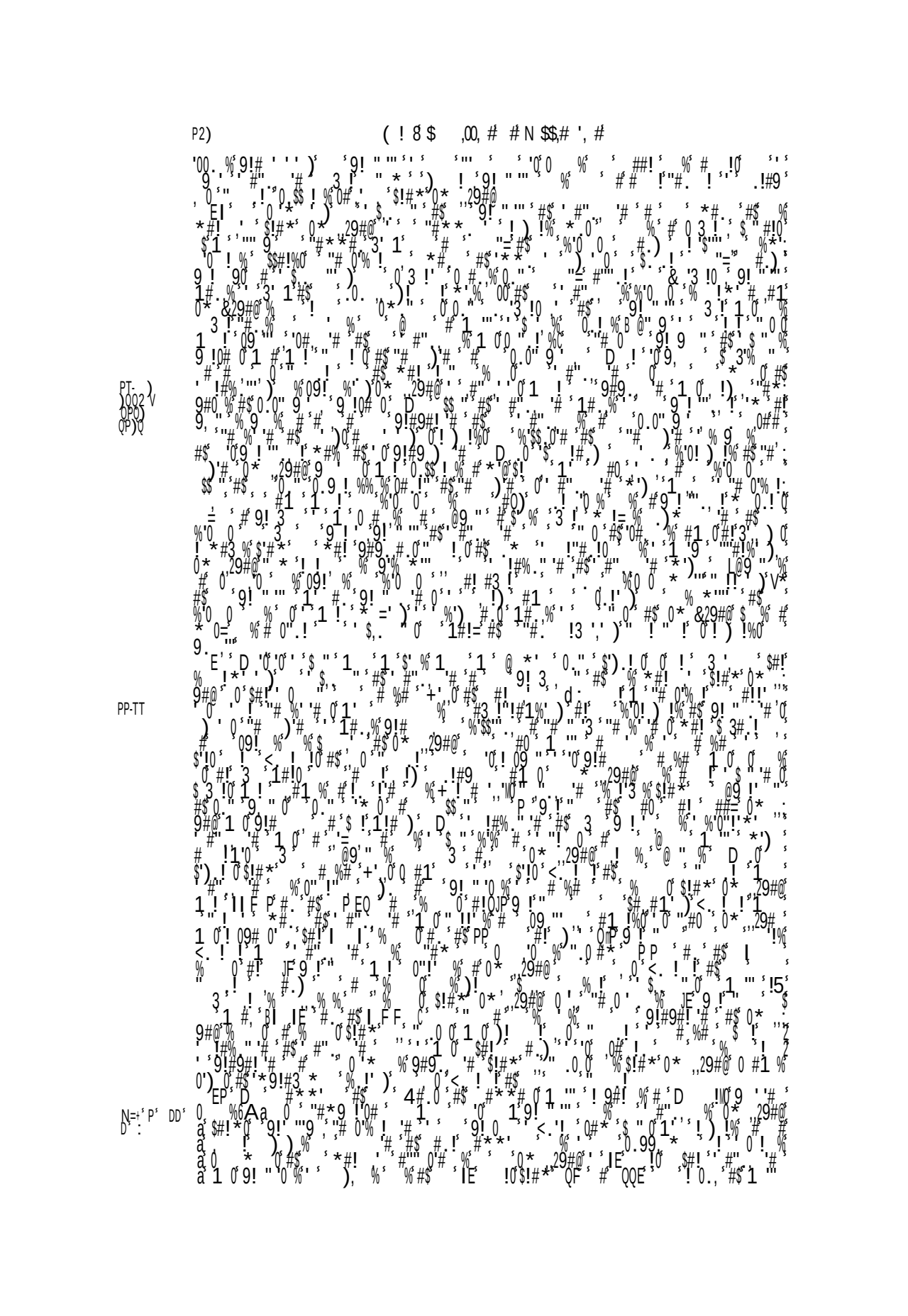

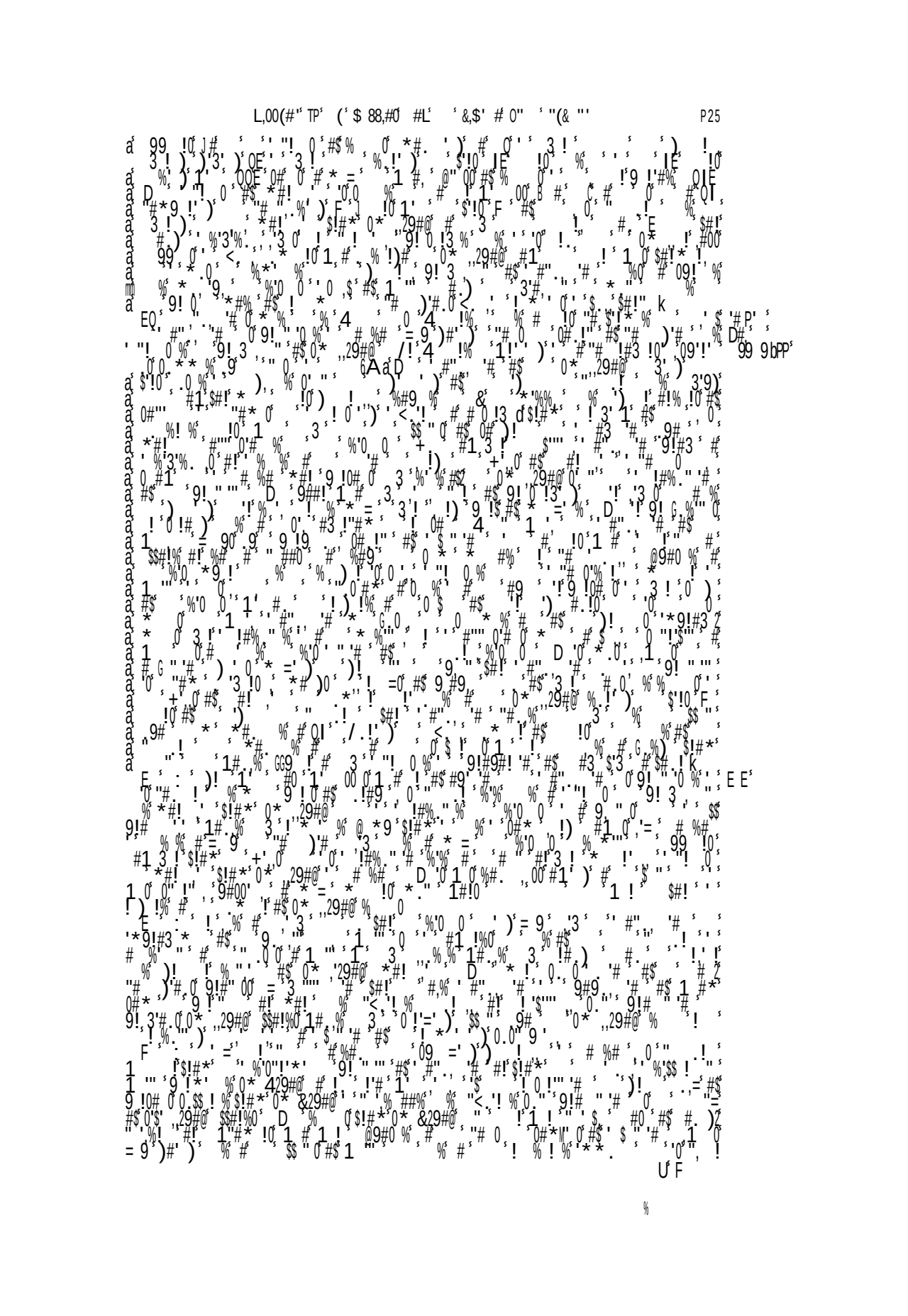

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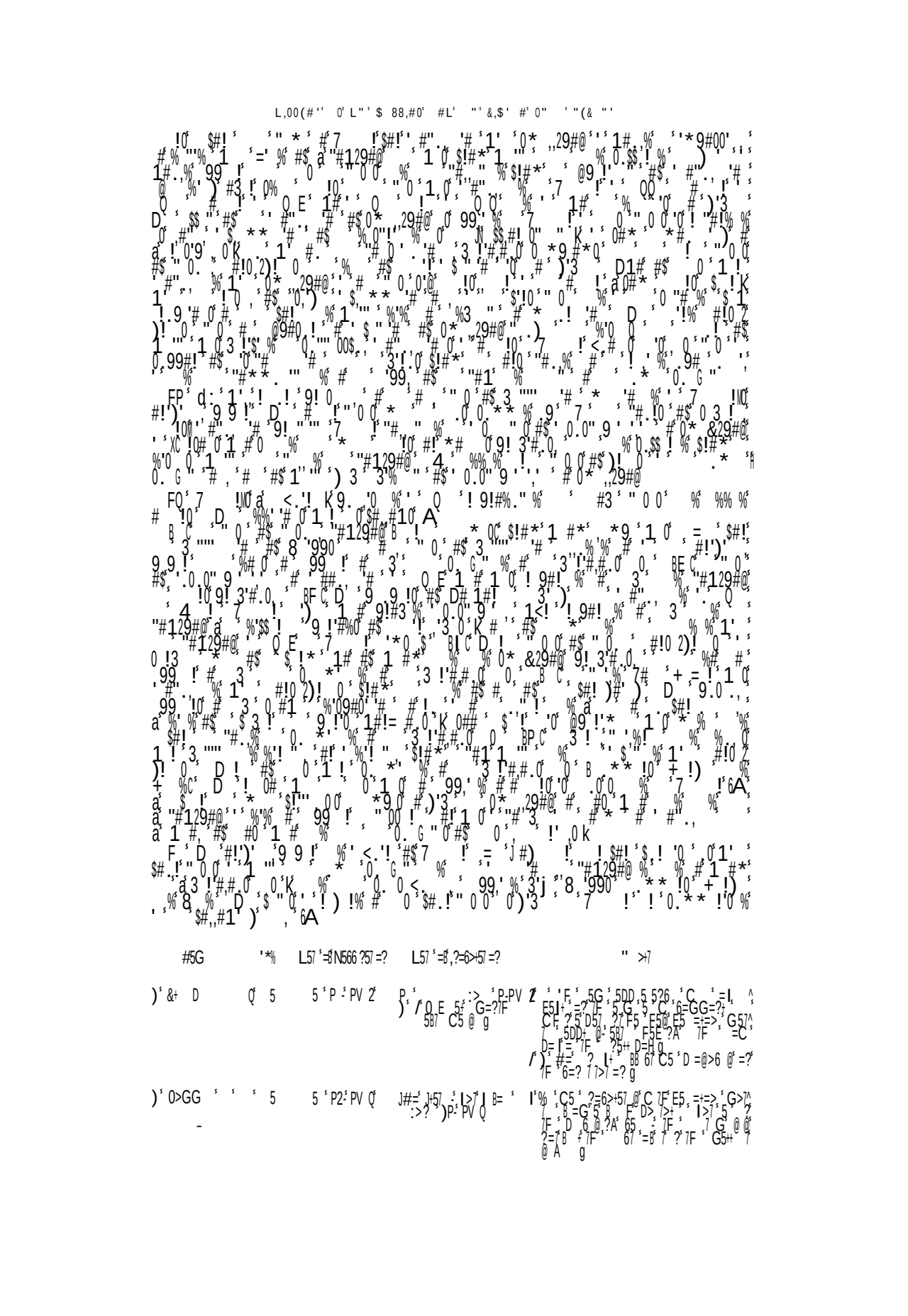

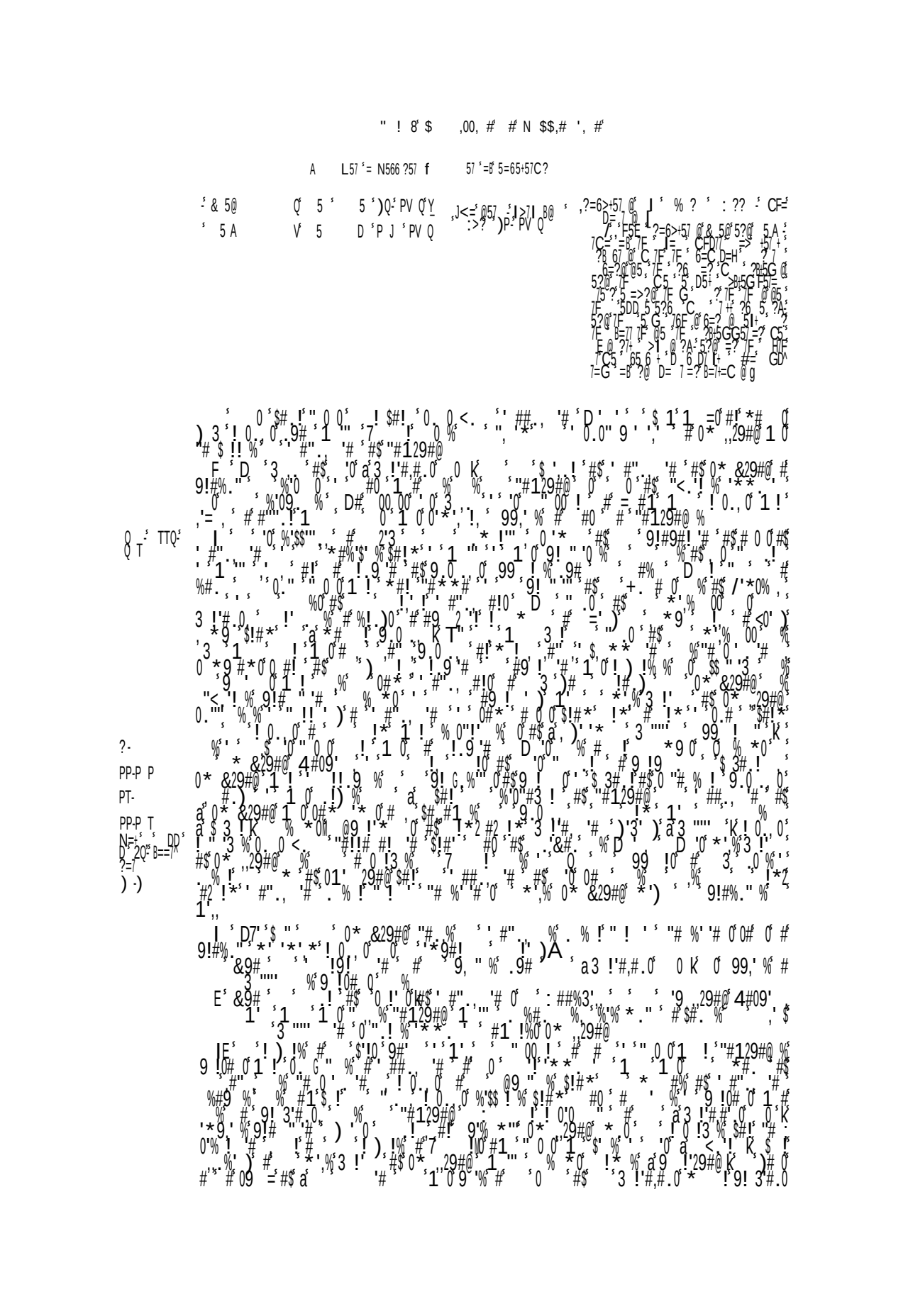

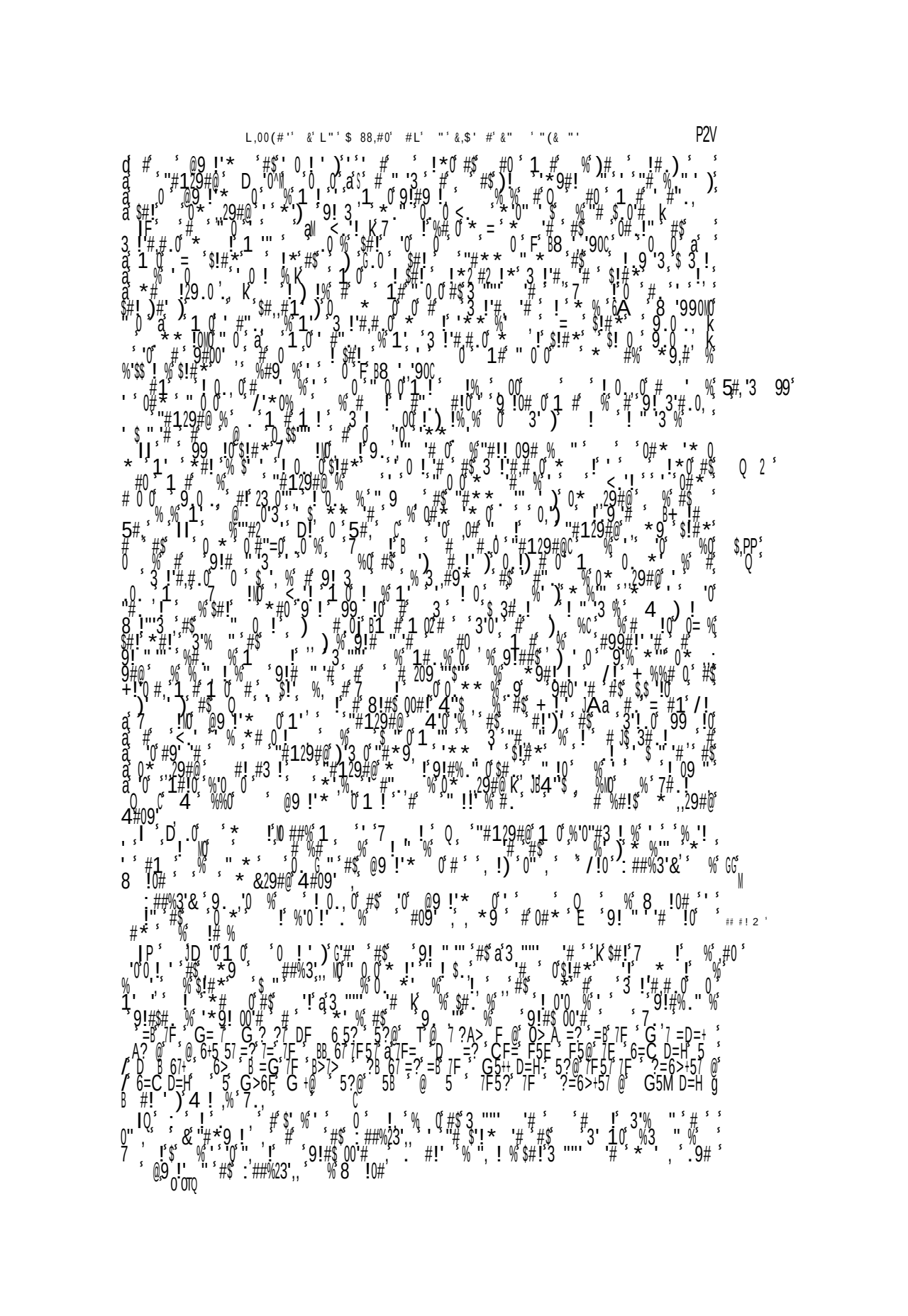

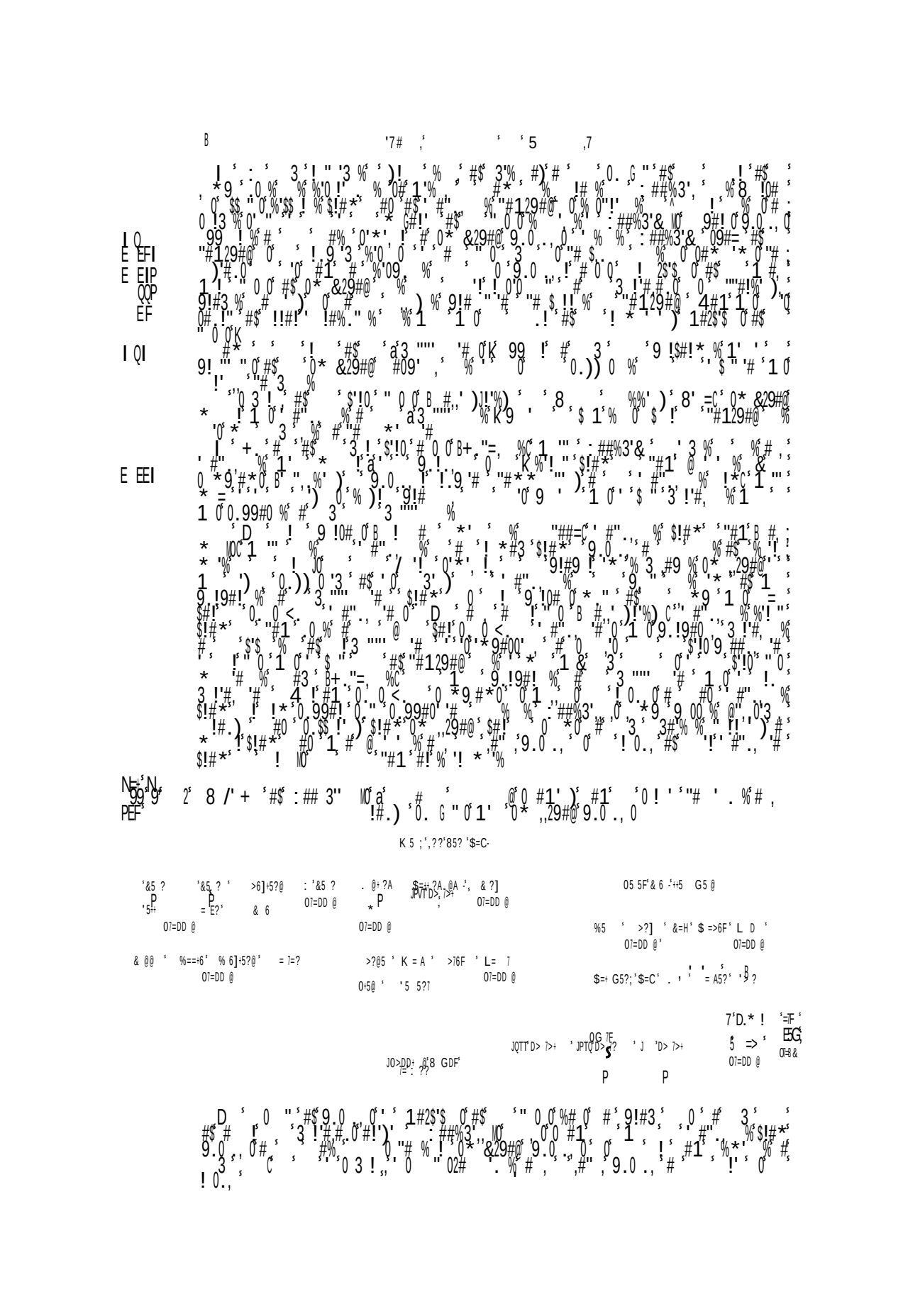

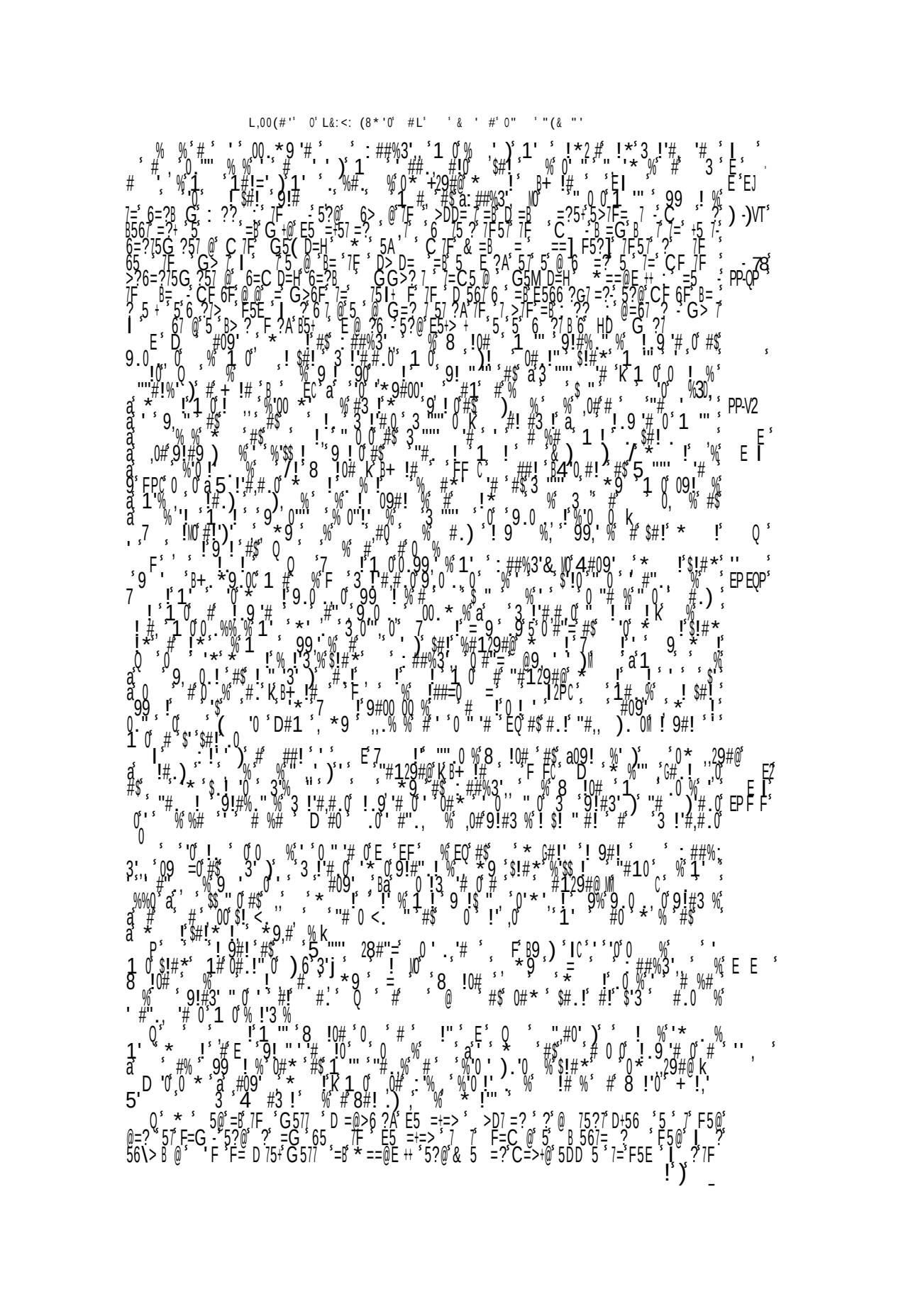

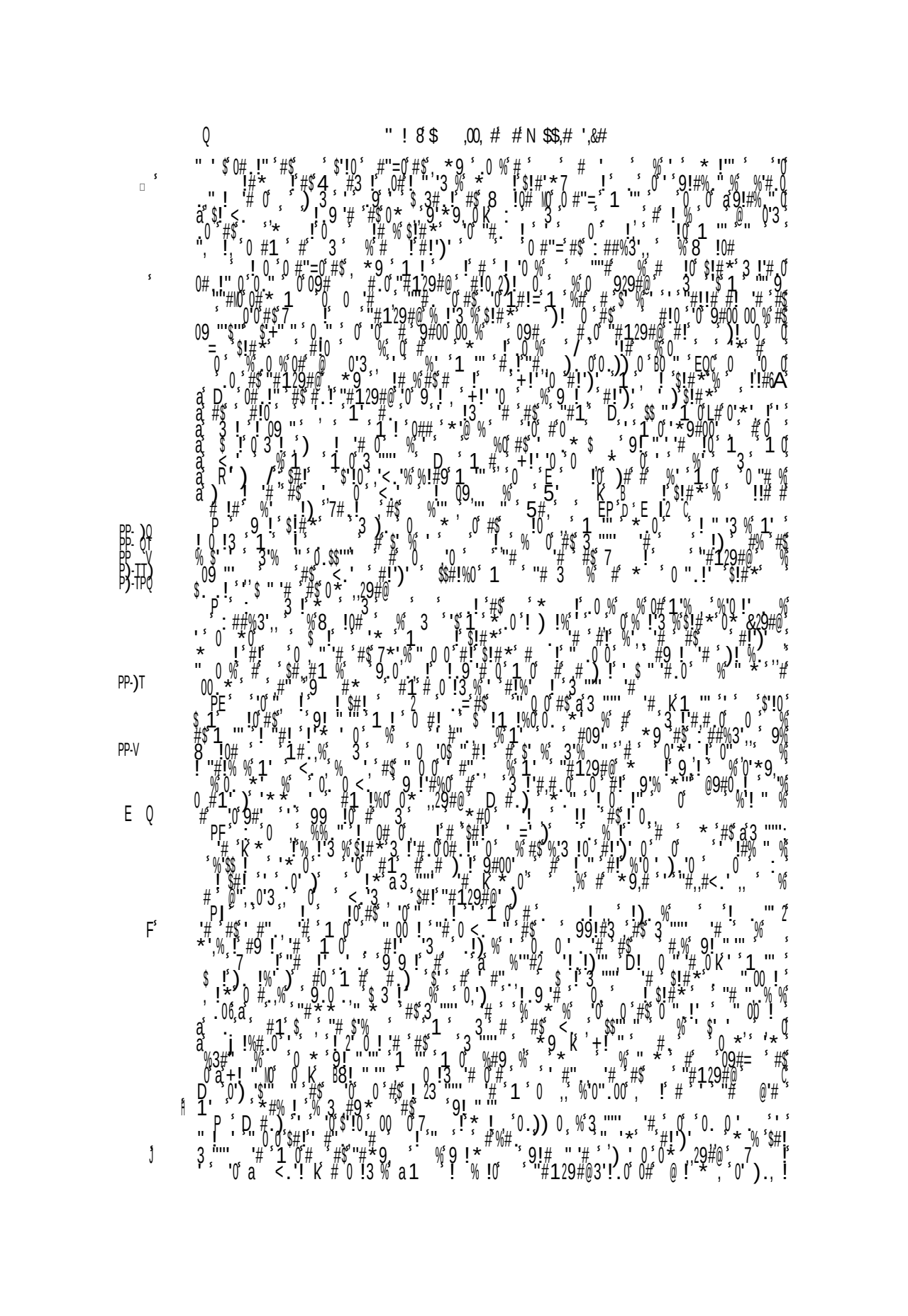

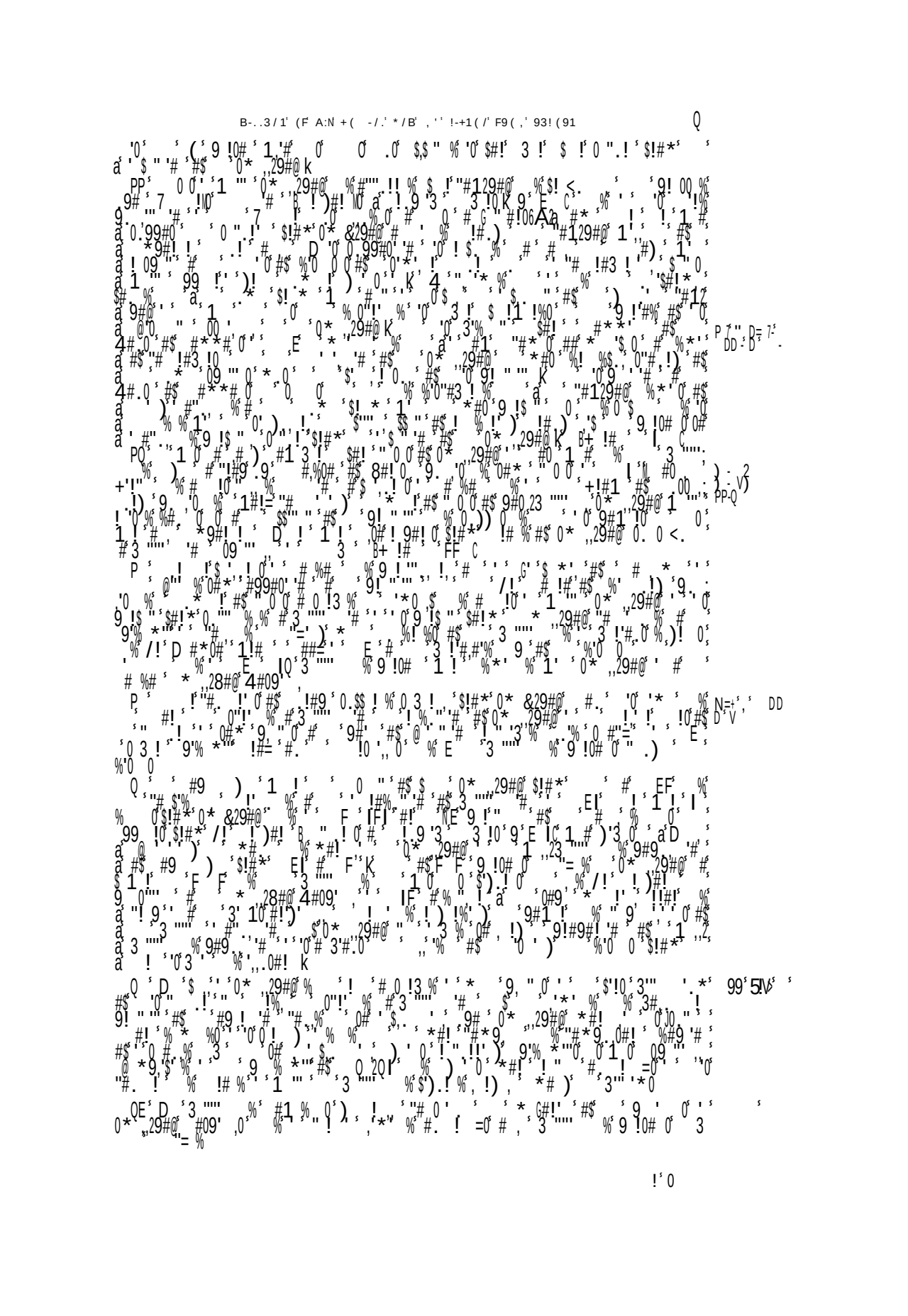

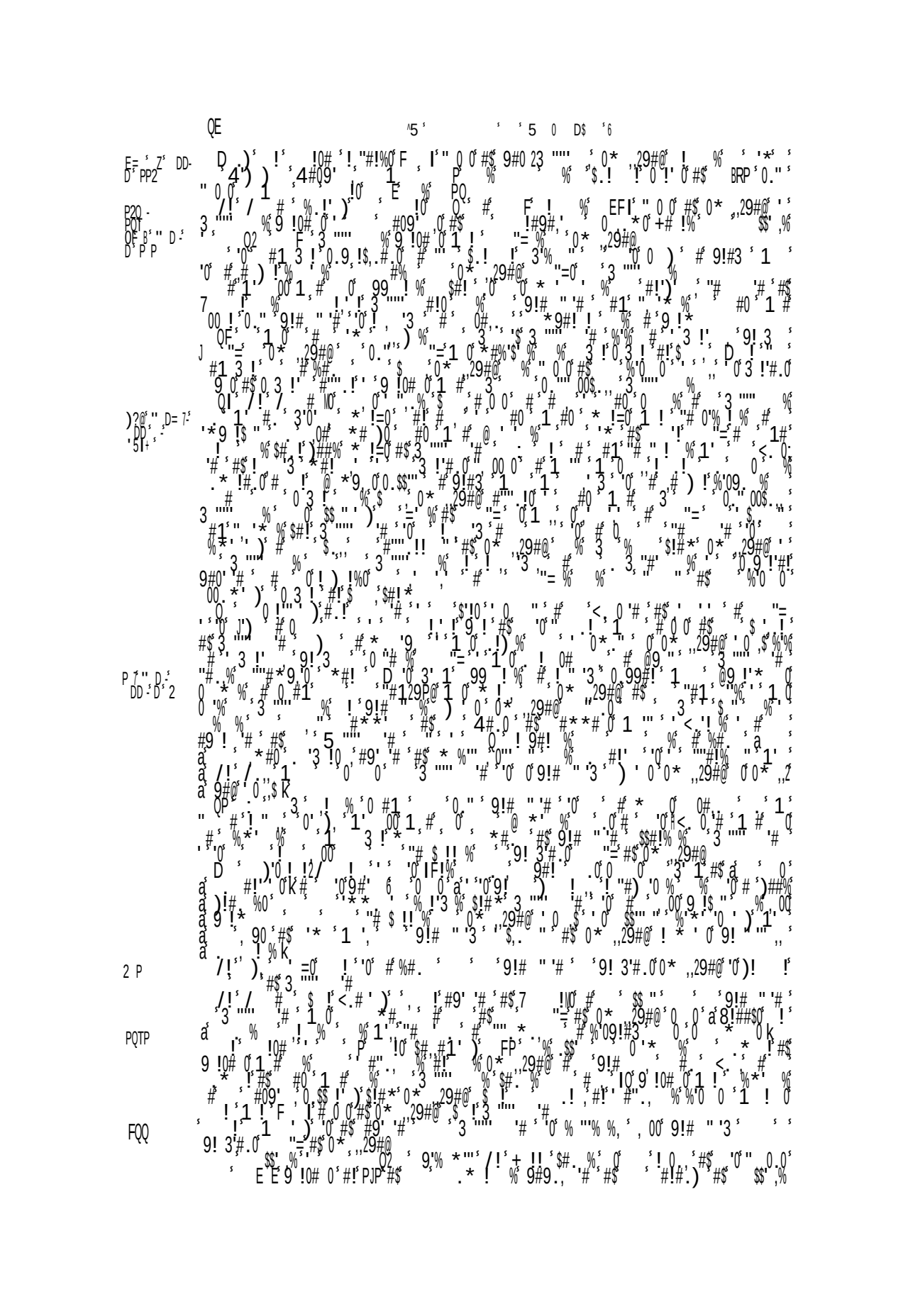

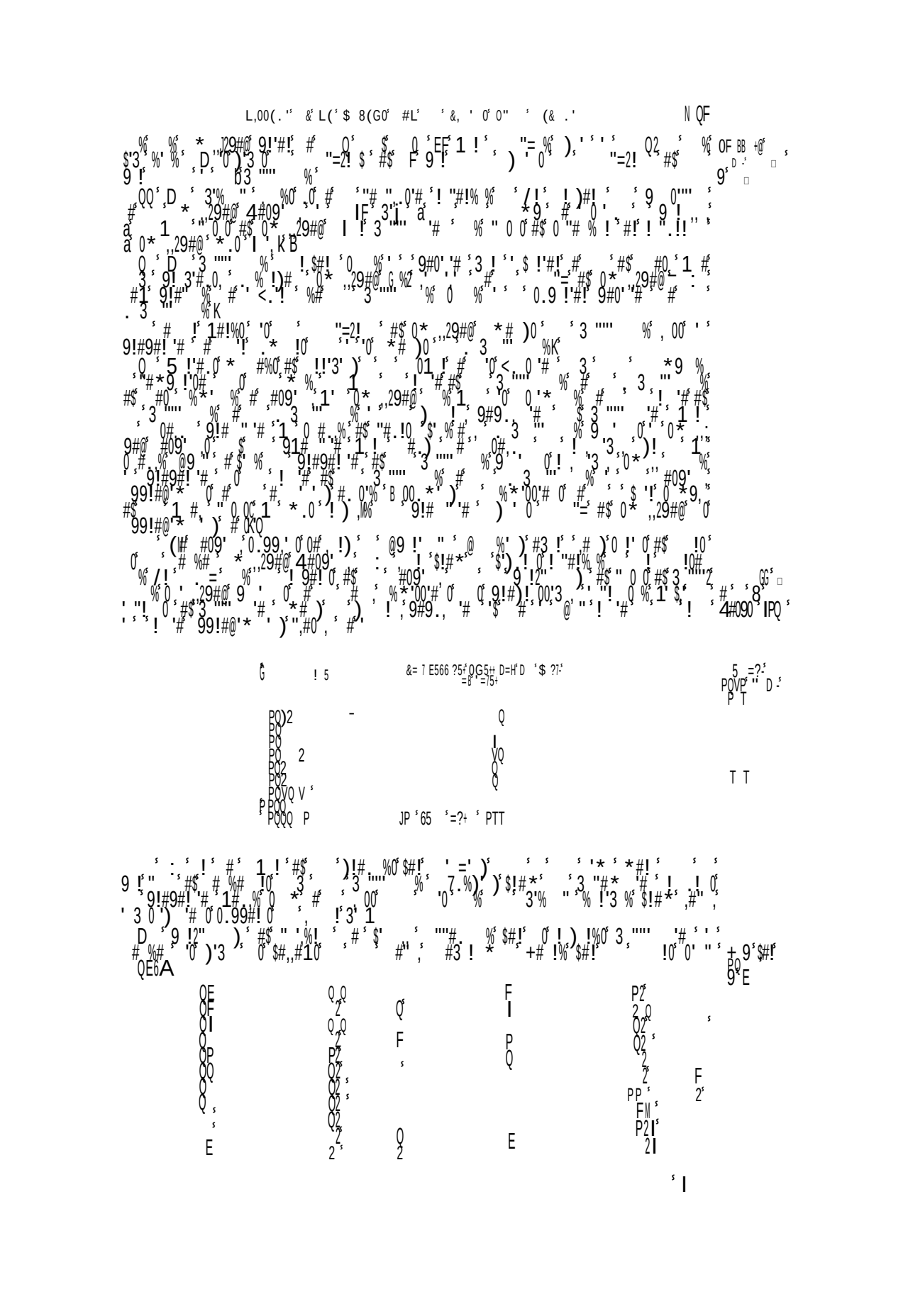

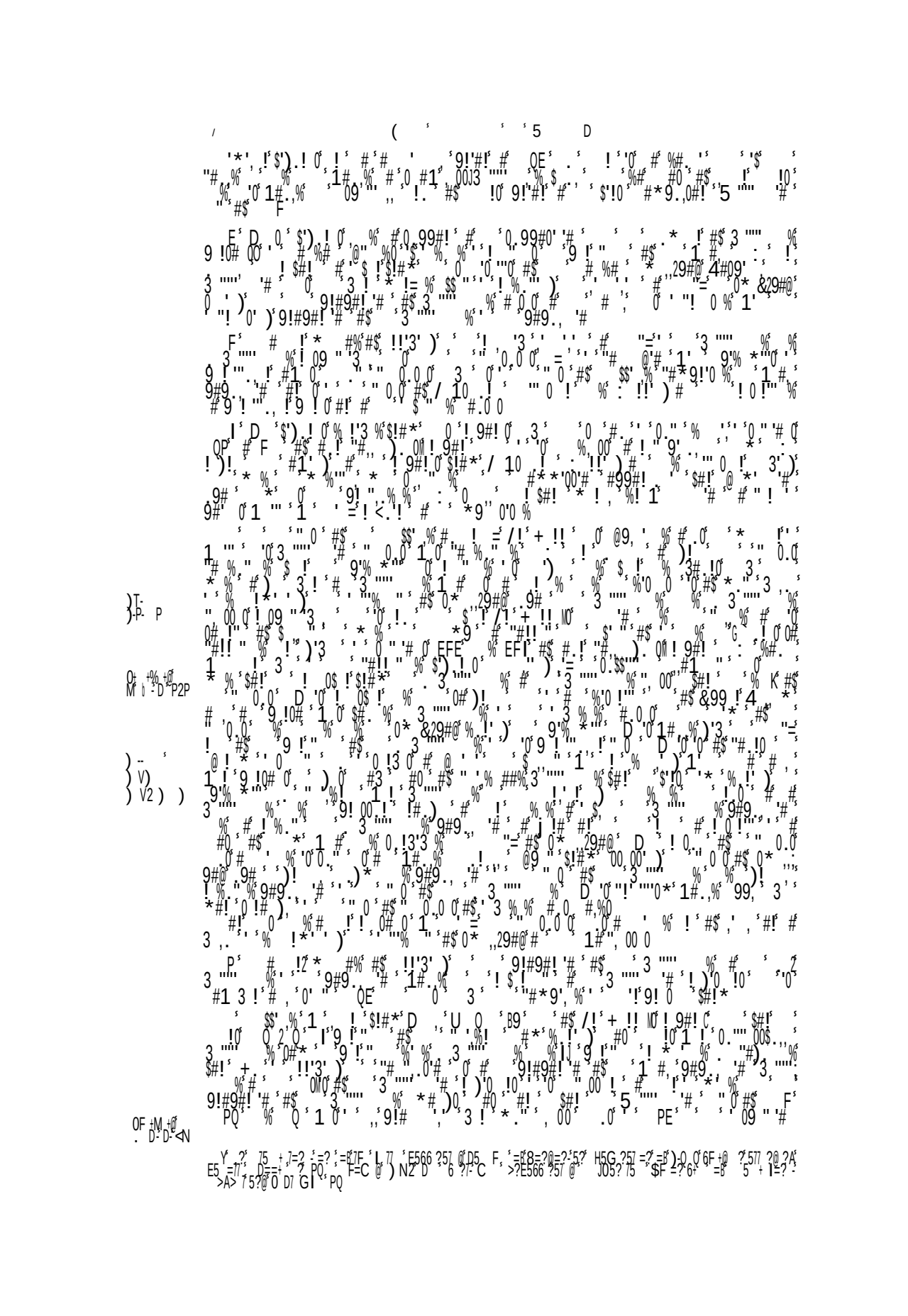

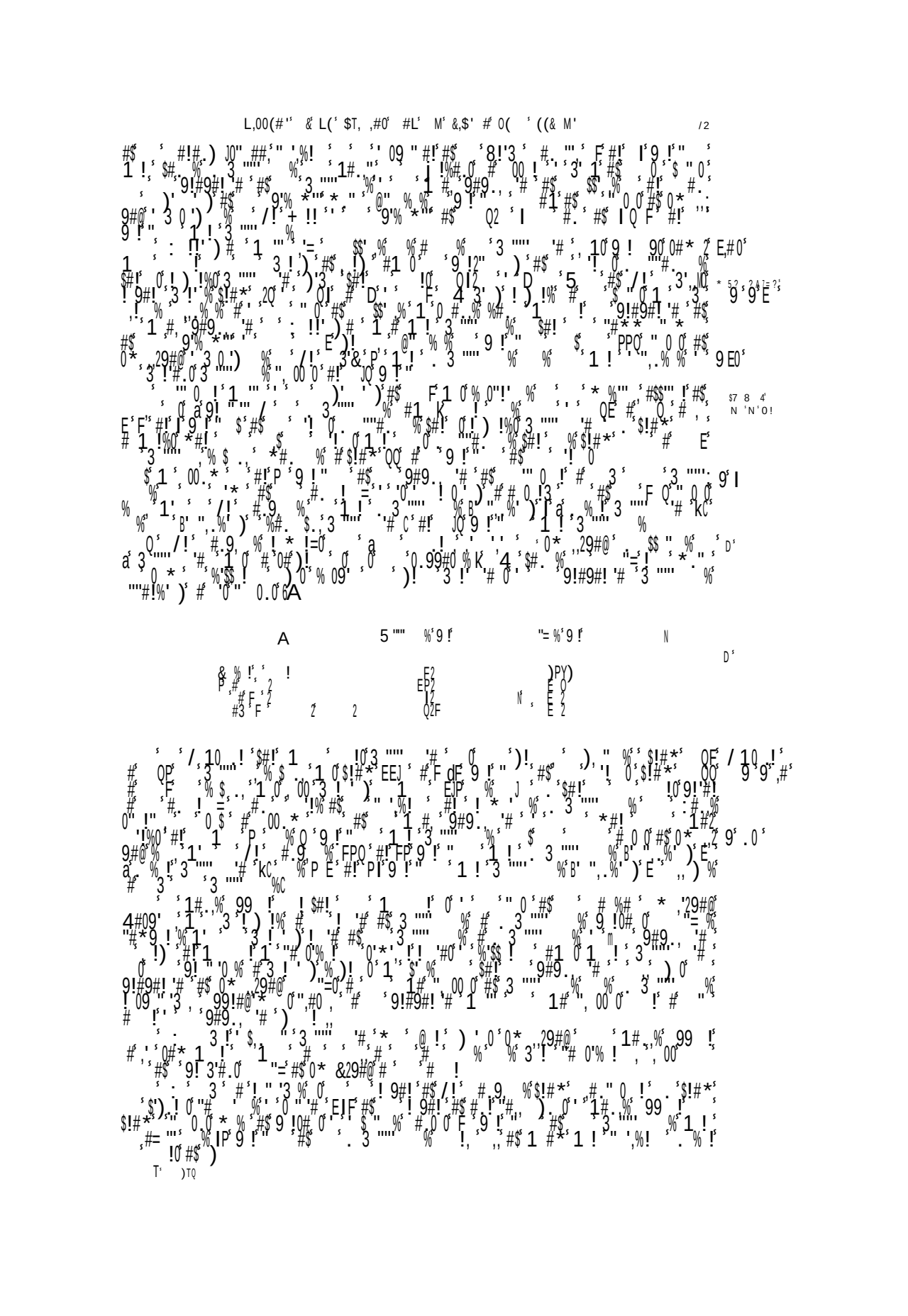

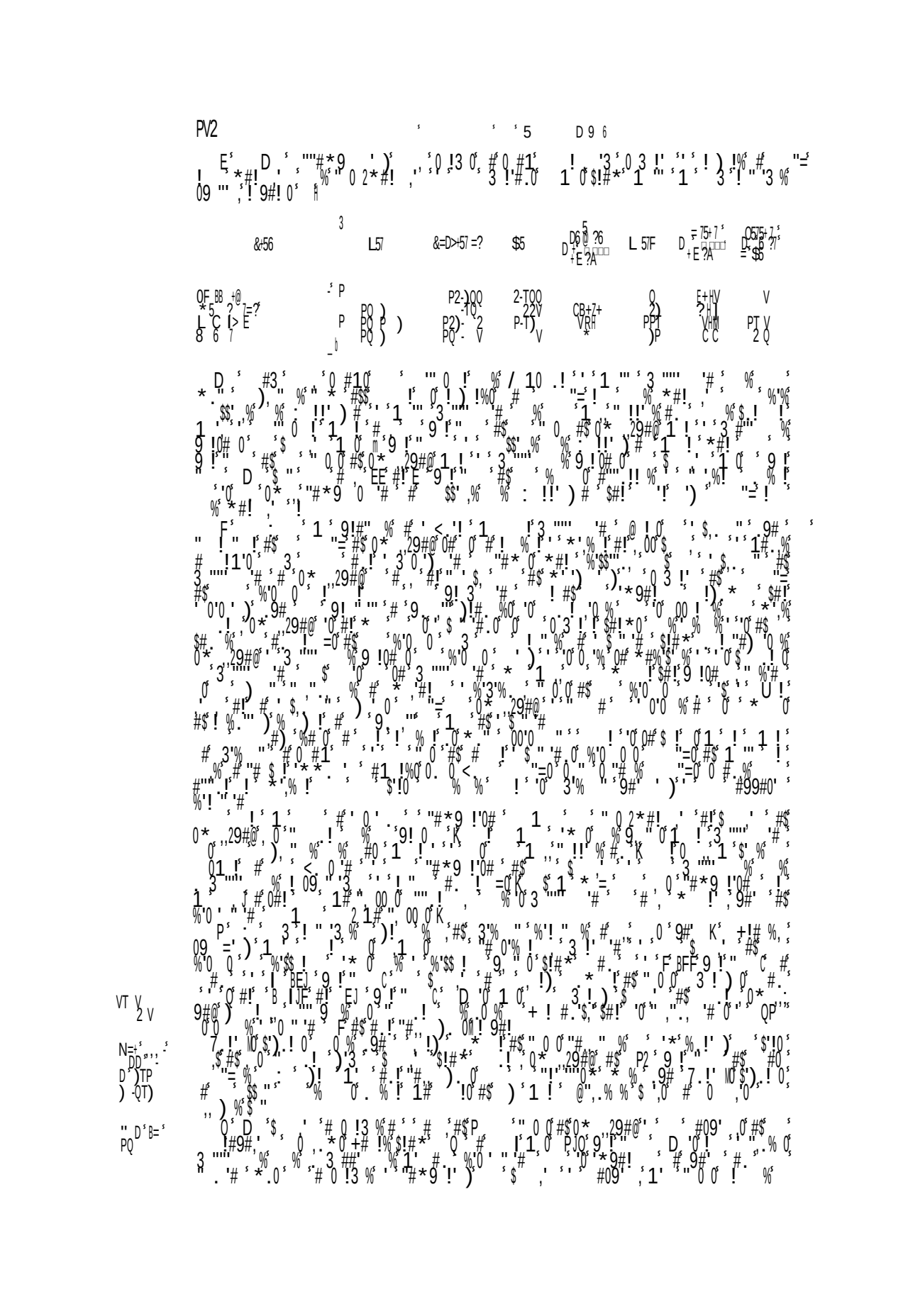

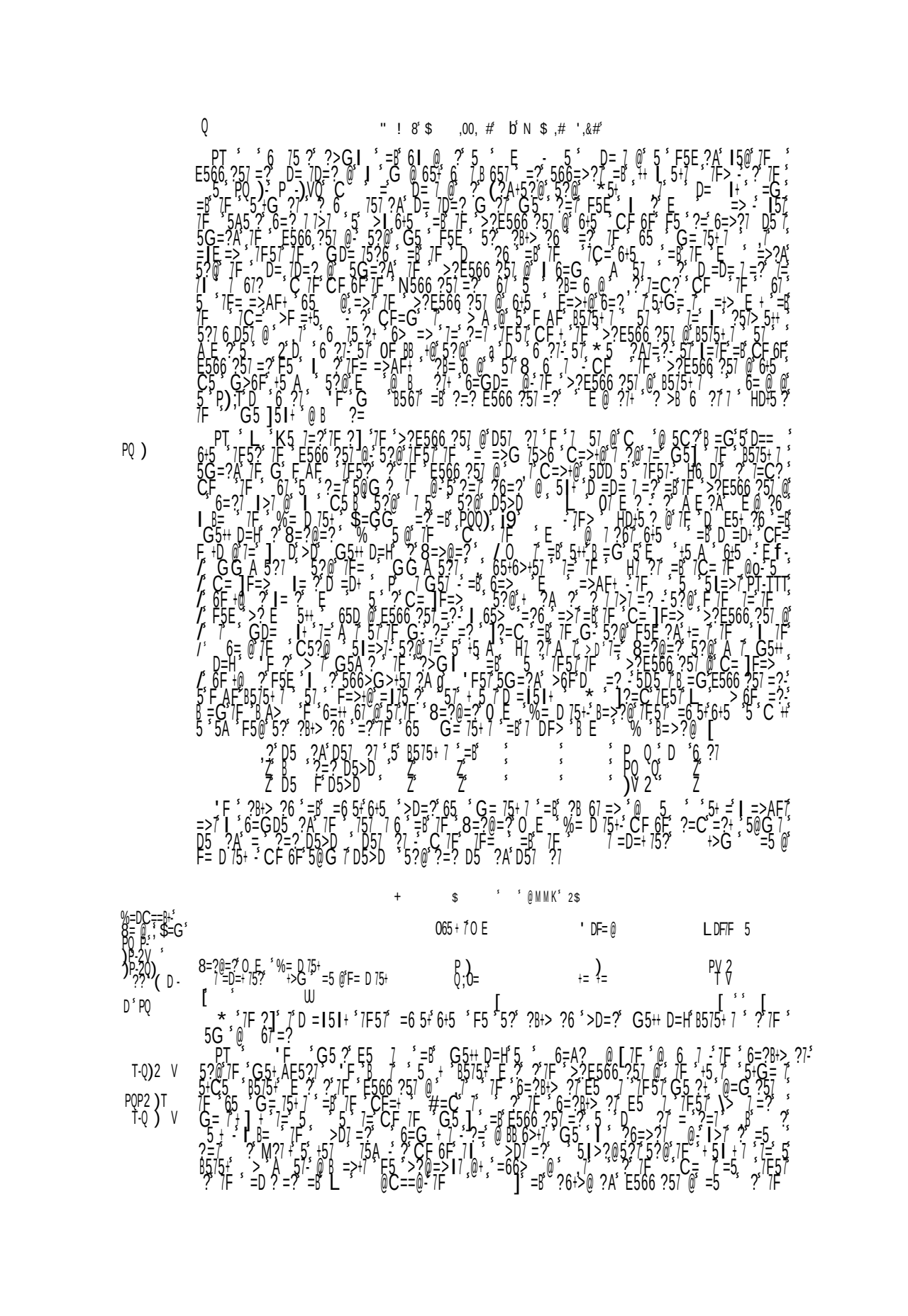

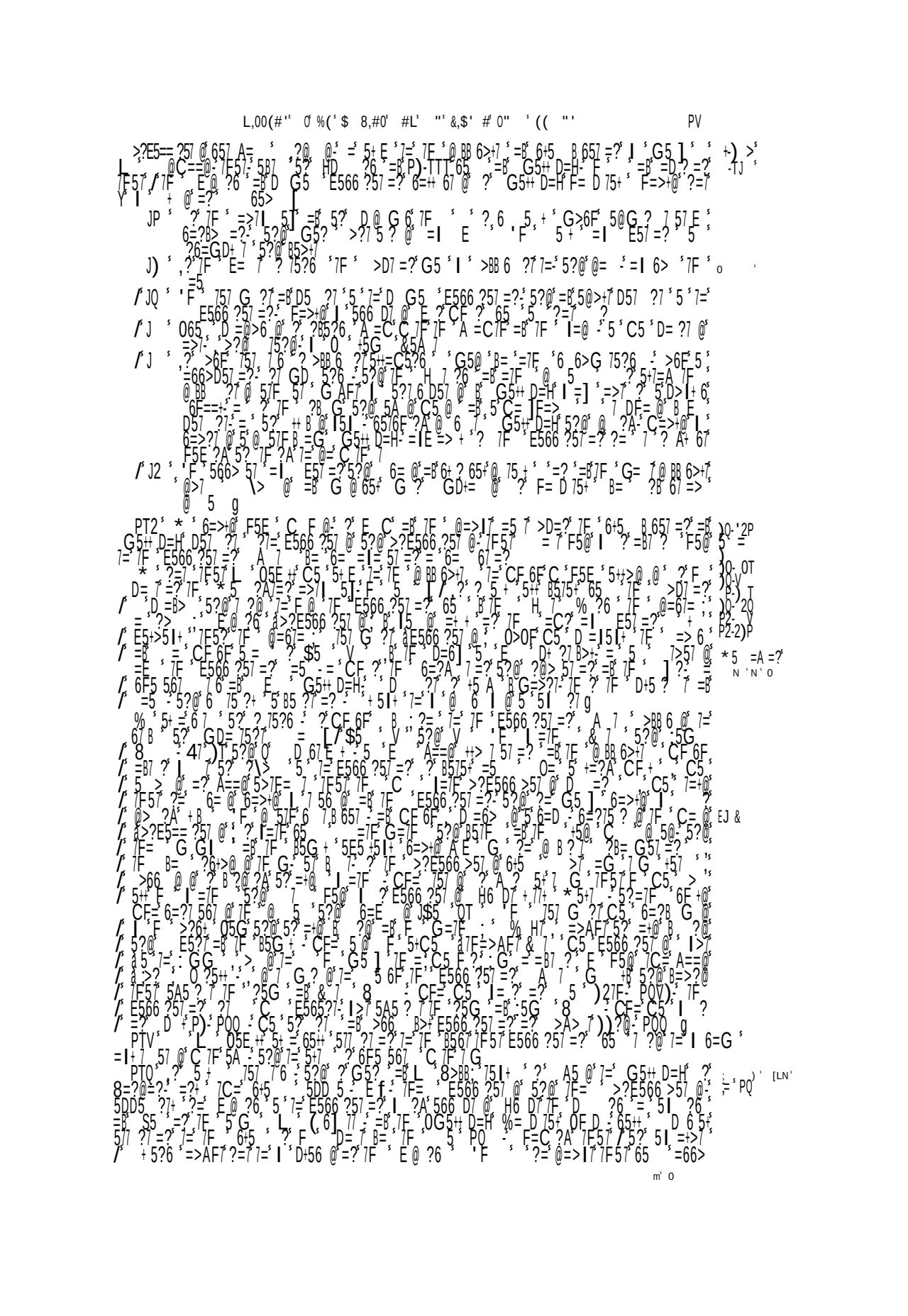

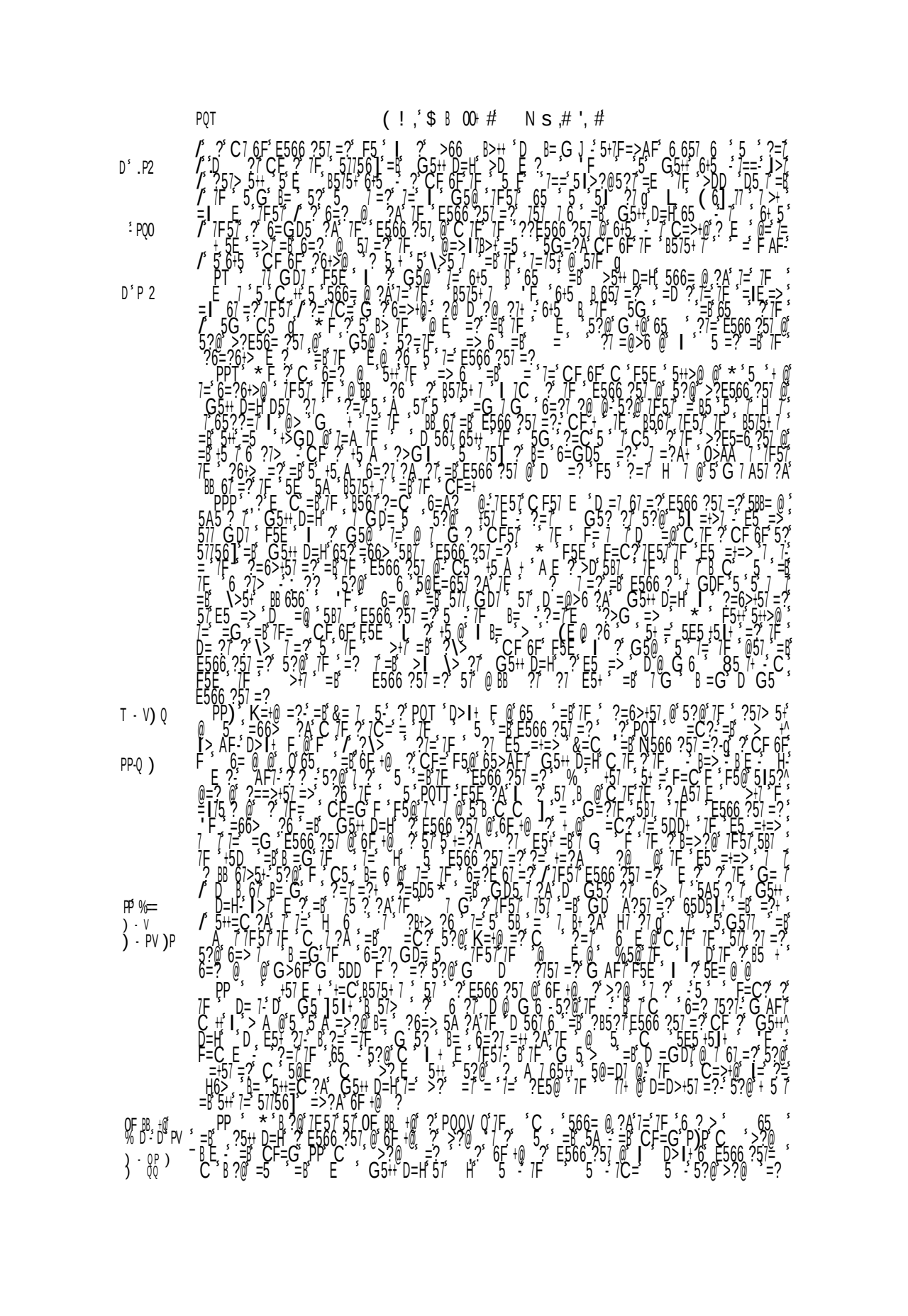

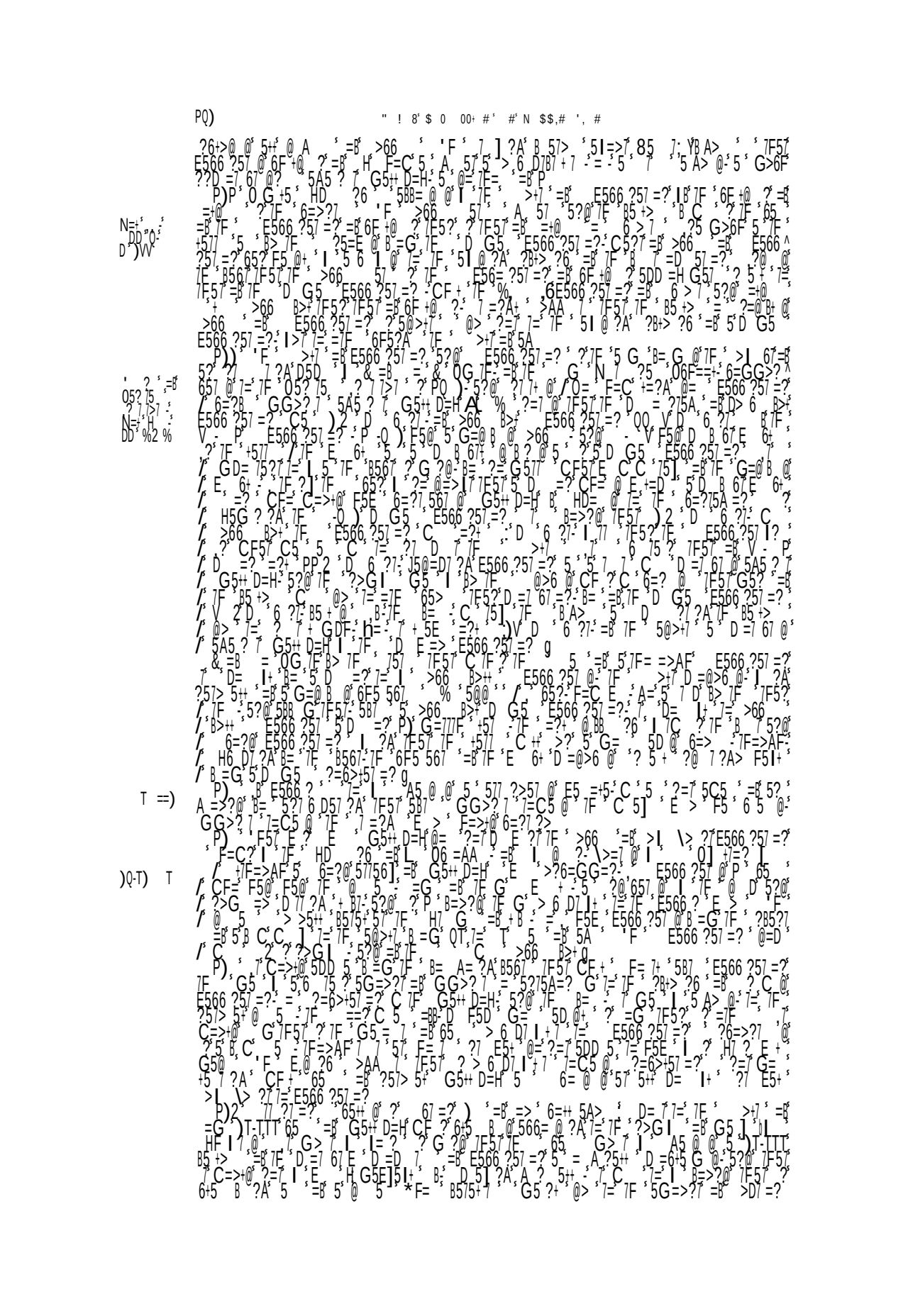

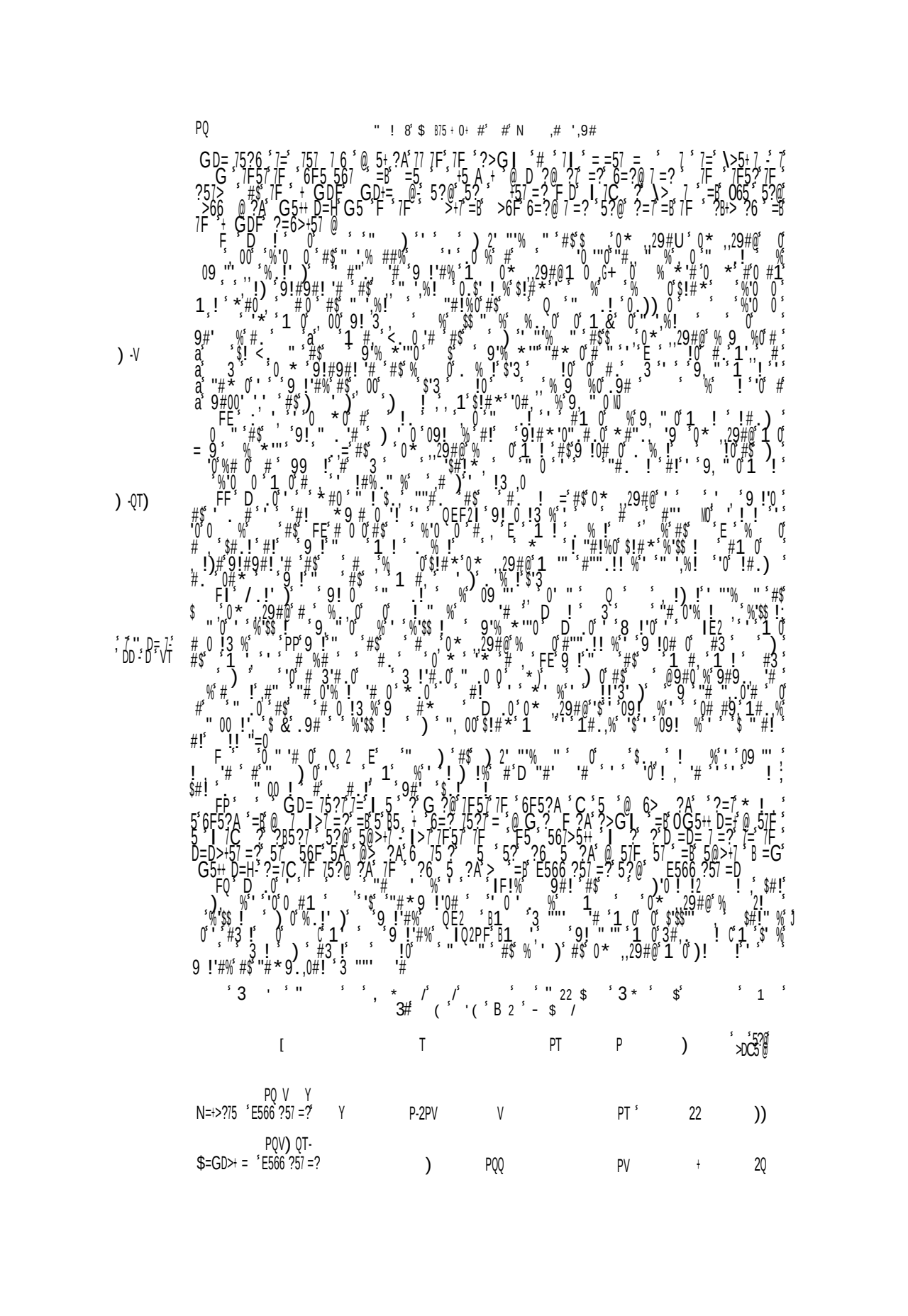

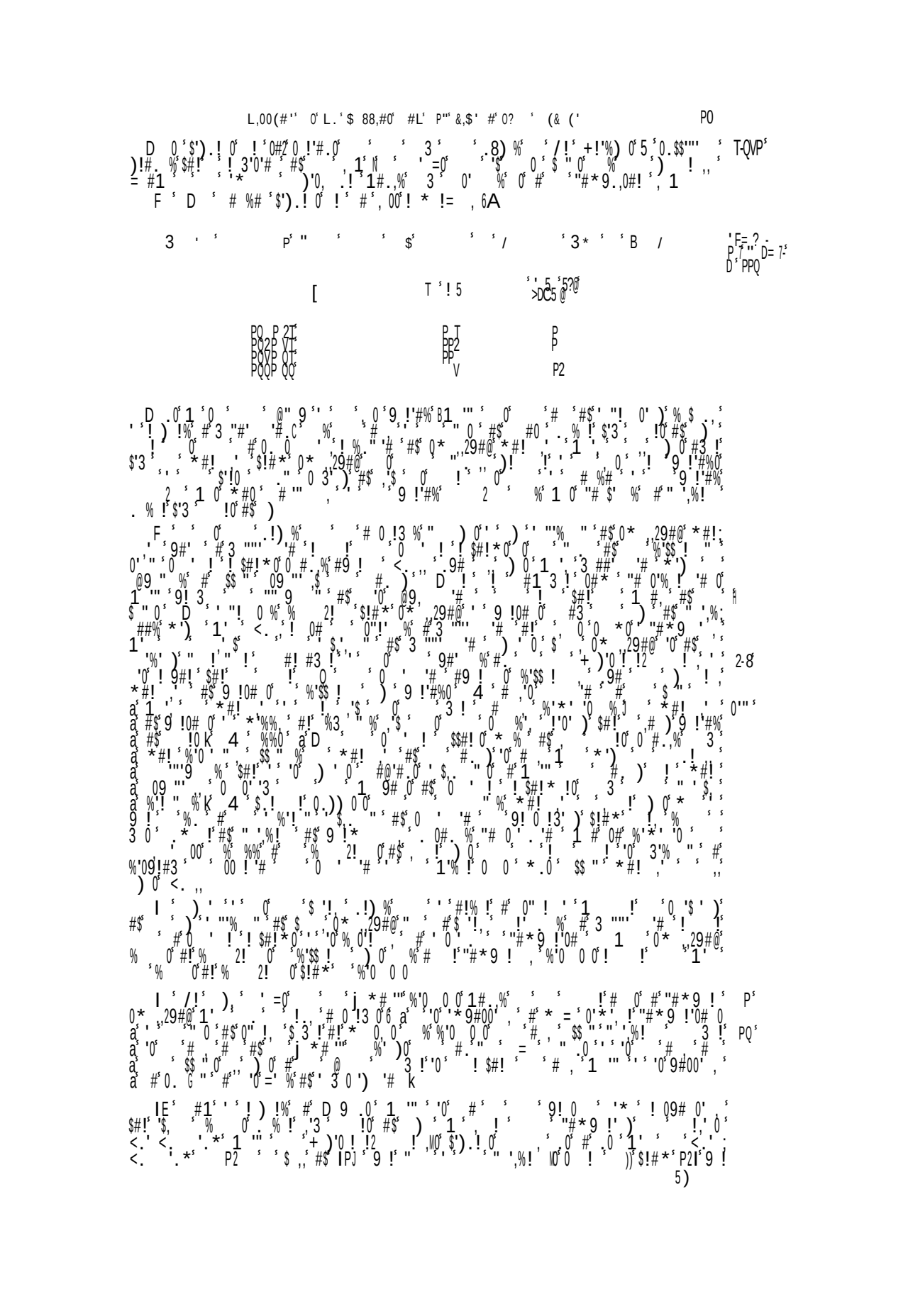

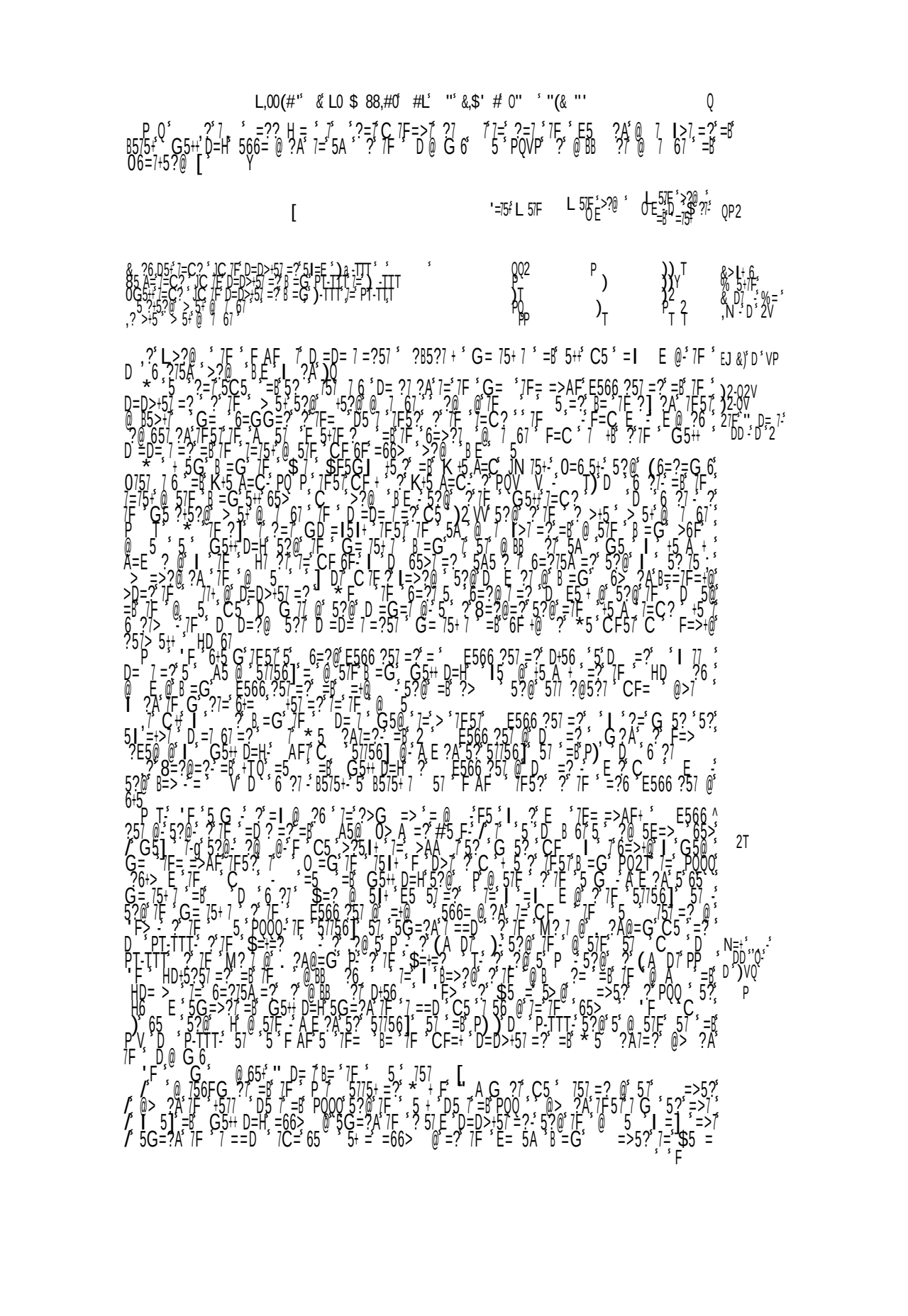

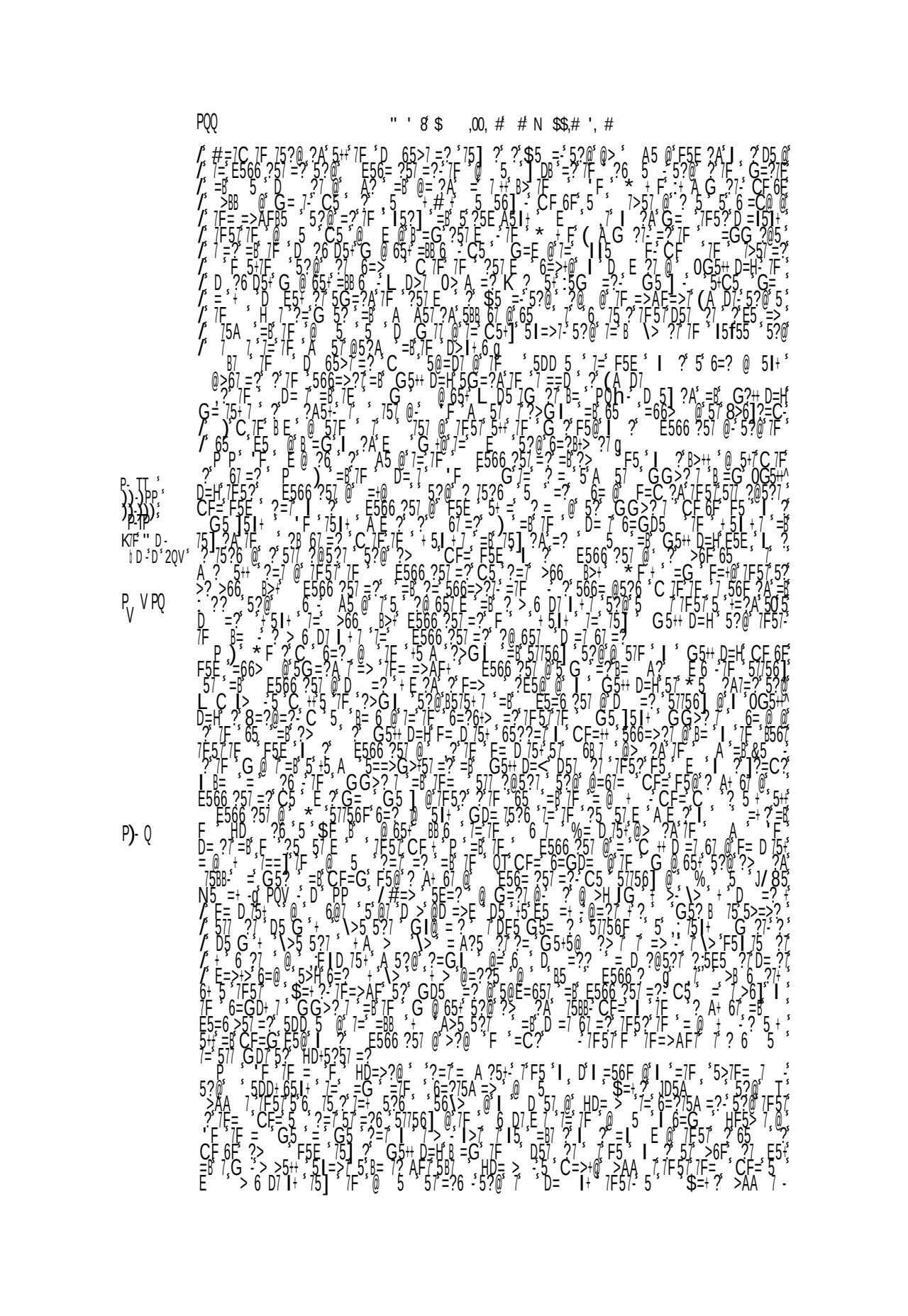

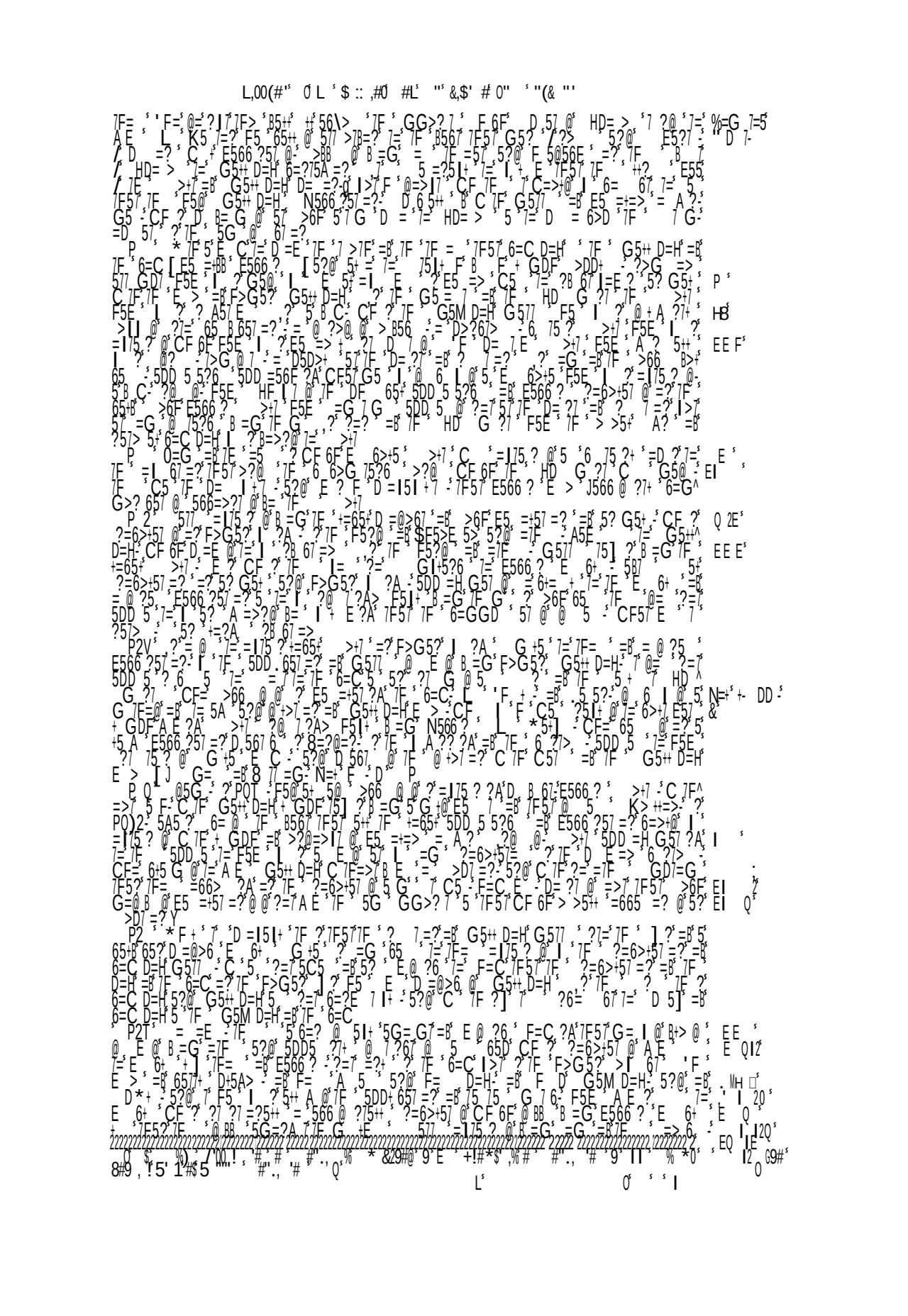

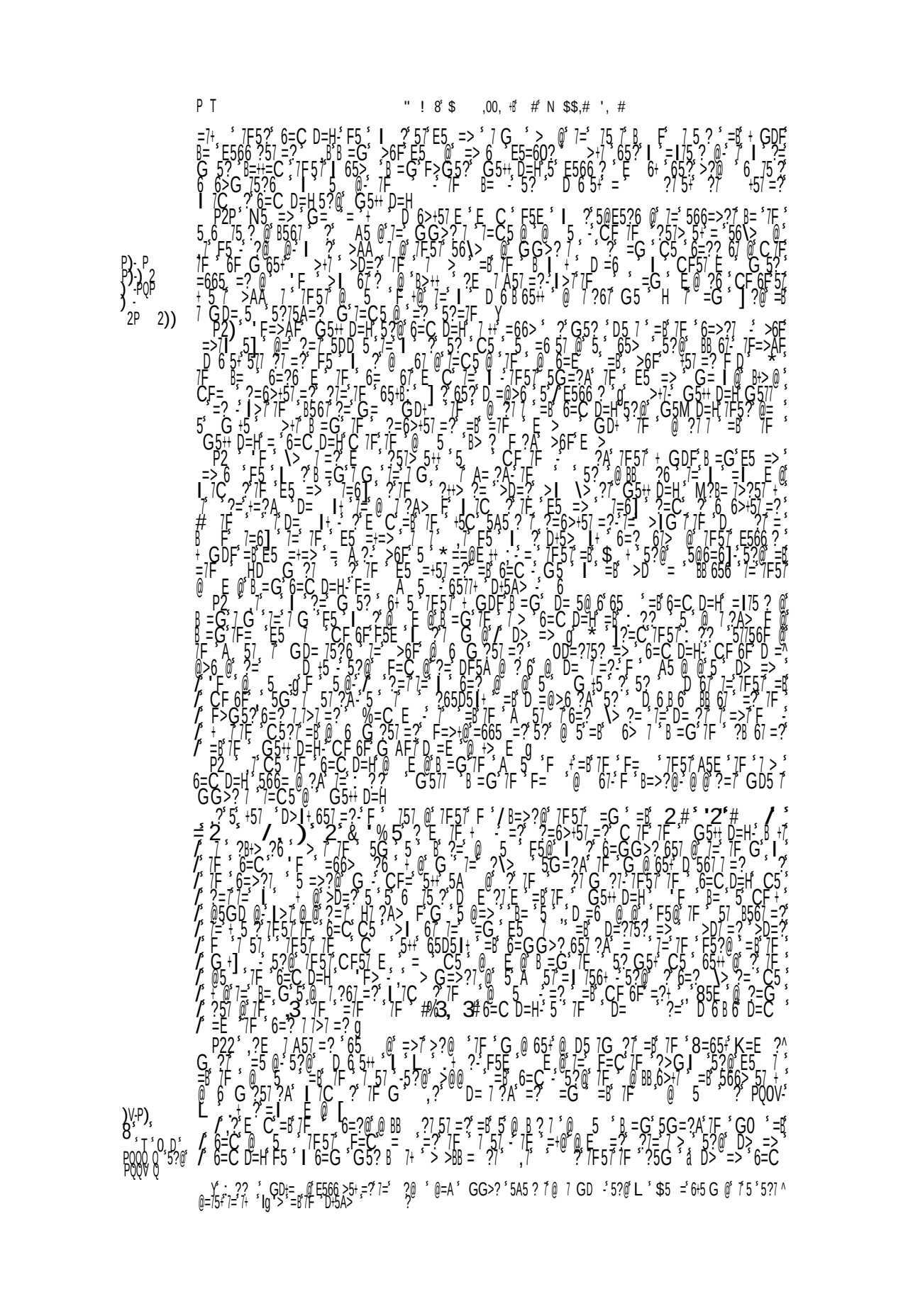

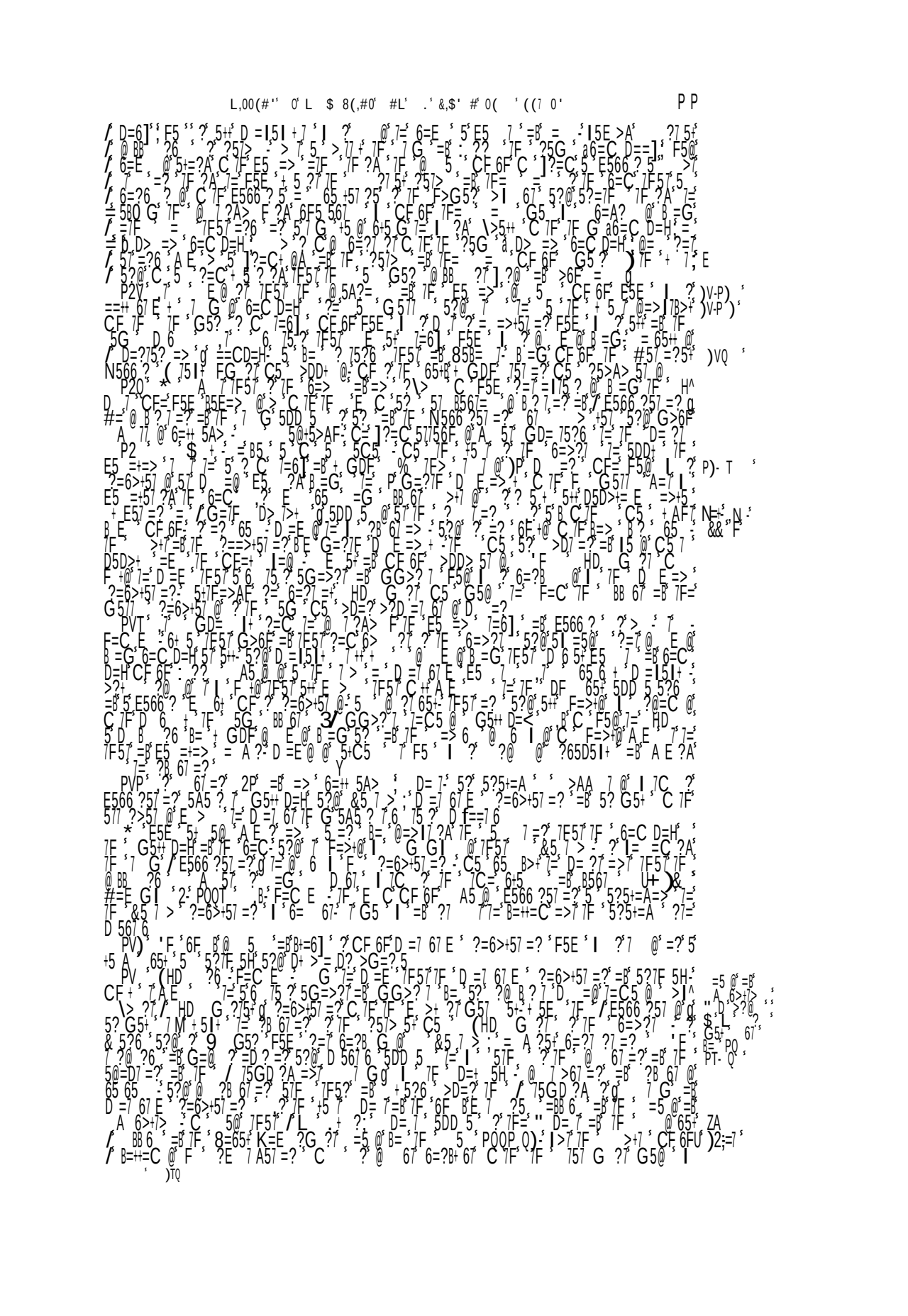

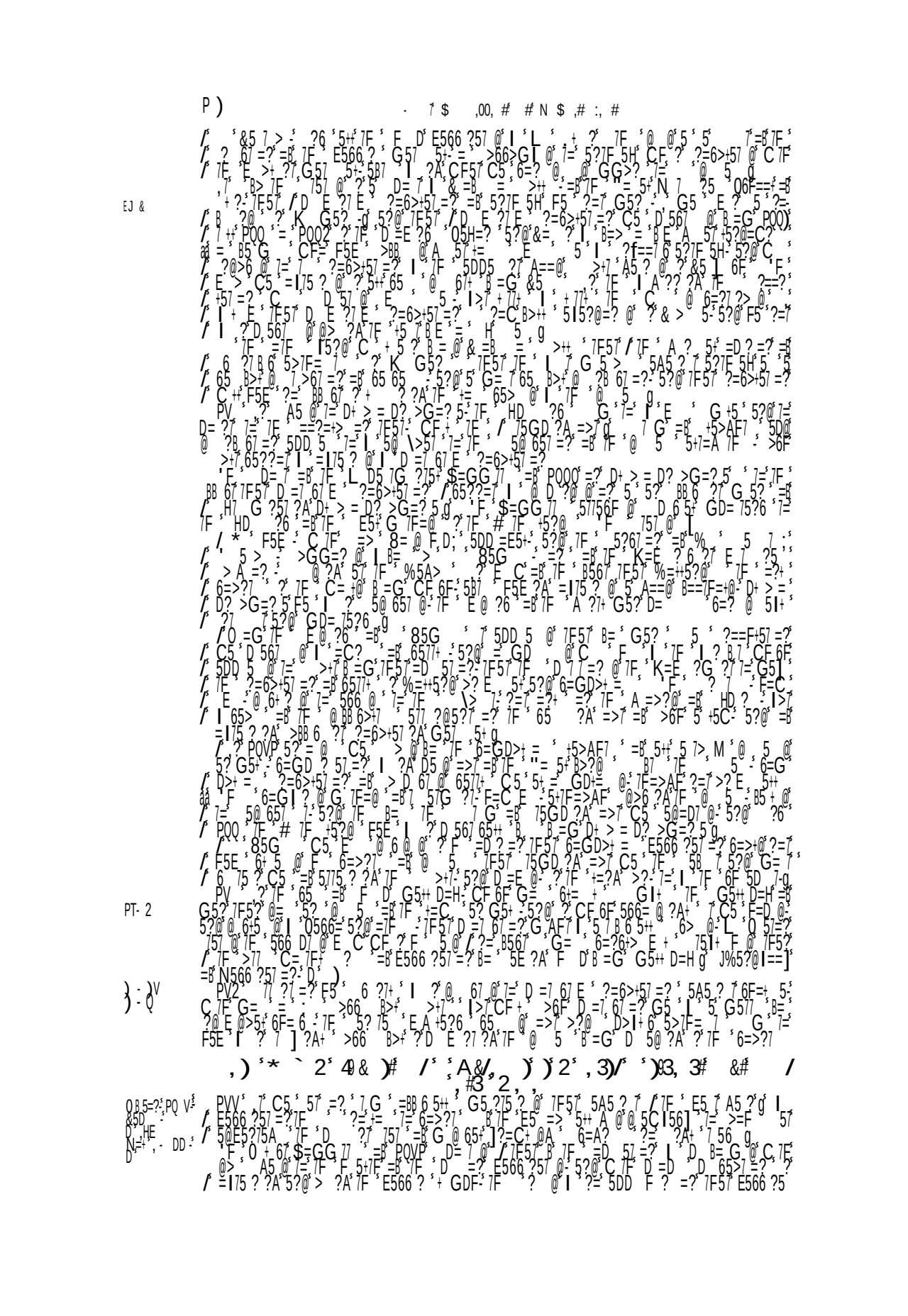

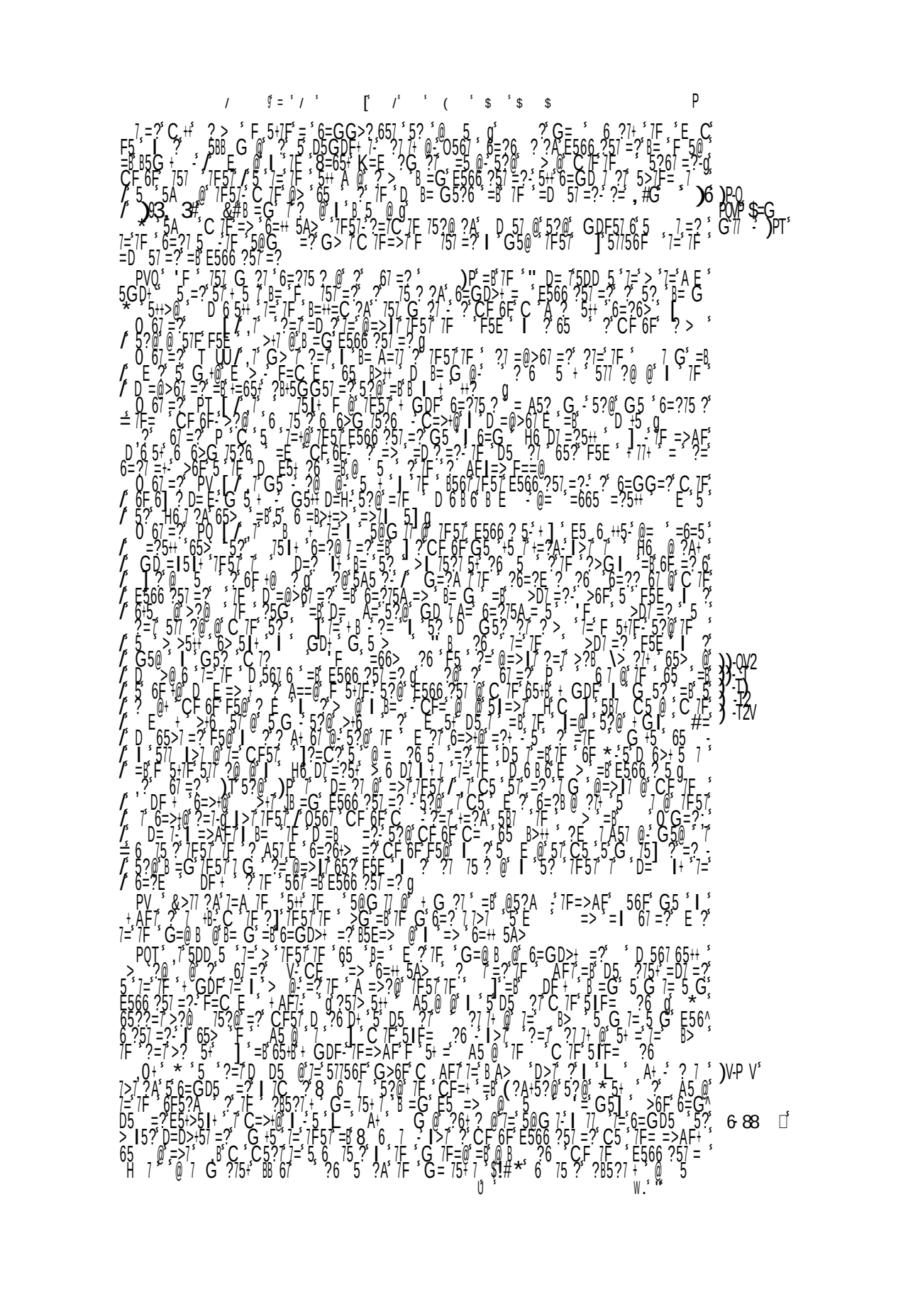

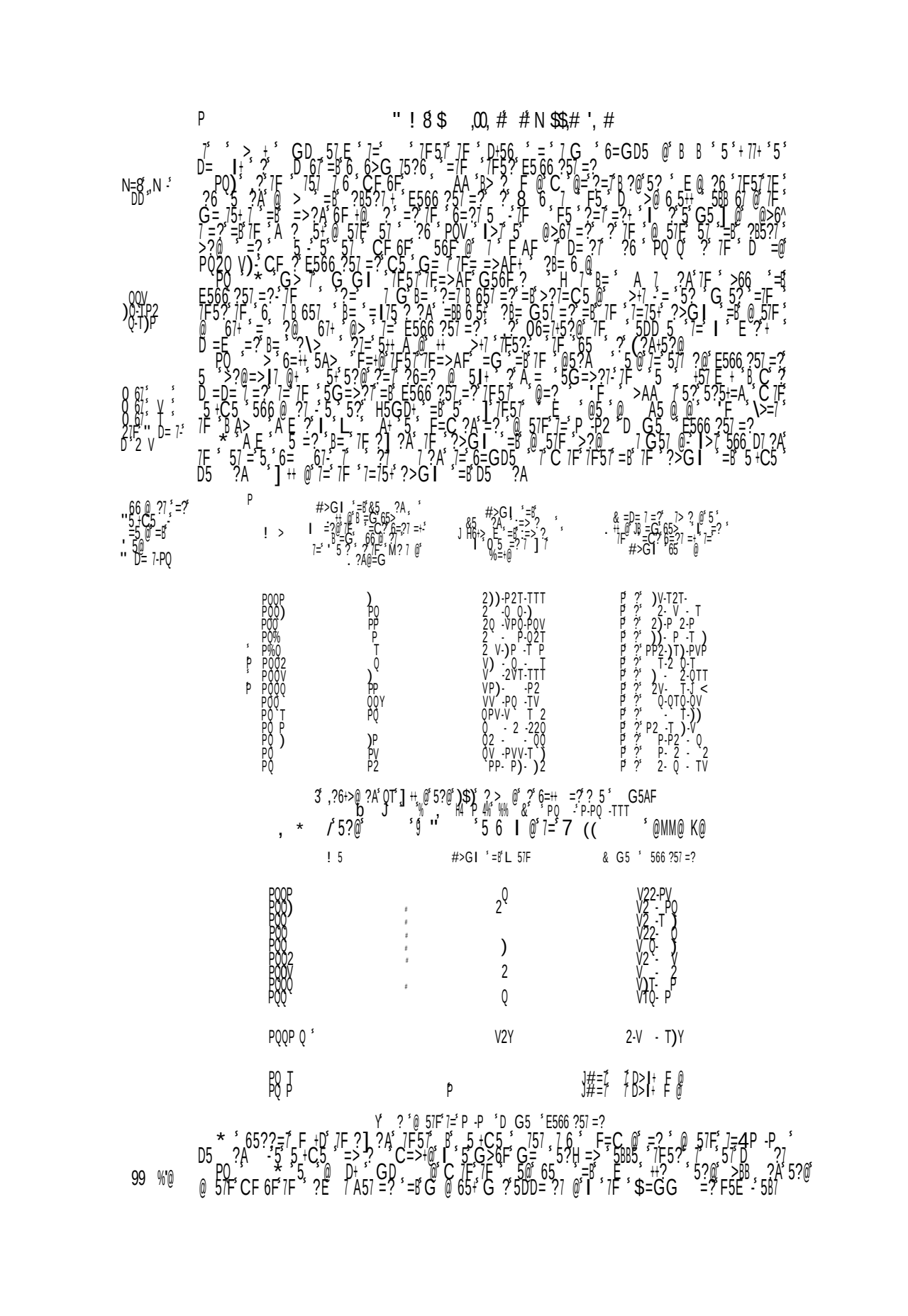

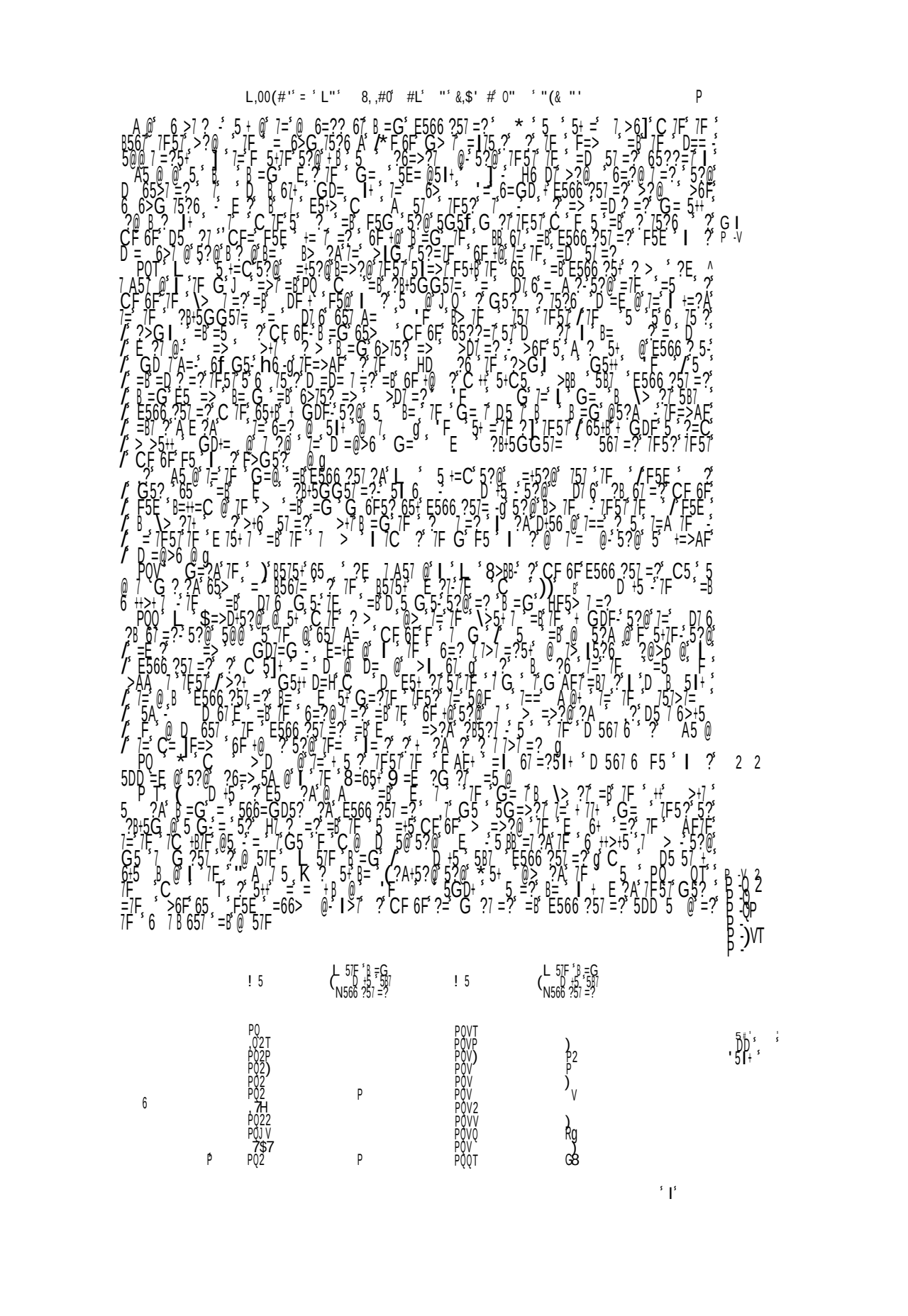

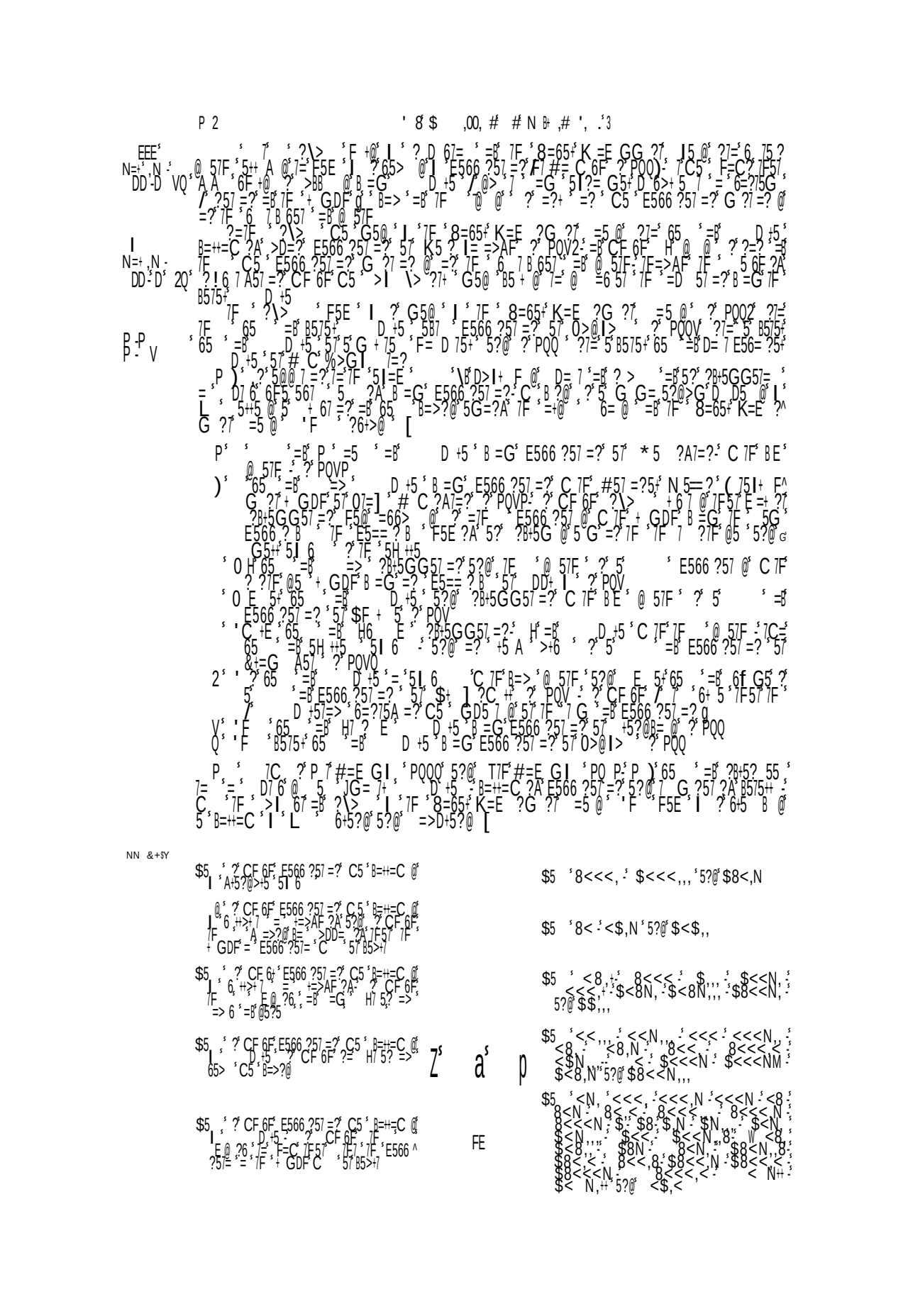

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$5 ' ?' CF 6F' E566 ?57 =?' C5 ' B=++=C @' I ' D 5 G 6 = ' A ? ' 5+ ' 6 D7 6 ' ?B 67 =?' 5?@' ?' CF 6F' 7F ' A =>?@' B= ' > ^ D 67 ?A 7F57 7F ' + GDF = ' 7F ' E566 ?57= ' C ' 57 B5>+7

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G ' D p

Z HH pJ

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$5 ' 8<<<,, ' <$N,, ' $N,, ' $N,, ' ' 5?@' $<<,

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$5 ' <,<

P ' #>G => ' 65 ' 5?@' 7C= ' = ' 7F ' ' =B' 65 ' =B' D= 7 E566 ?5+ ' D +5 ' F5E ' I ?' ?E 7 A57 @' I ' G @ 65+ G ?' 5DD= ?7 @' I ' 7F ' $=GG =? ' JO ' $5 ') ' PP ' PQP ' DD ?@ H

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/' ?5+ ' =B' 7F ' 65 ' F=C ' 7F57 7F ' D =A ' =B' 7F ' E566 ?57 =?' ?' =G ' D 67 ' @ E A @' B =G ' 7F ' 7 D 65+ 6=>

,?' 7F ' G5 = 7 ' 7F ' C5 ' 5 D G57> ' @ E +=DG ?7' =B' 7F ' E 6+ ' CF 6F' C 7F ?' 7C= ' = ' 7F ' @5 ' 5B7 ' ? 7 =?' B= G @' I =] ' 5?@' @ 6F5 A @

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,?' =?' 65 ' J#= ' ' 7F ' +=65+ 6=?@ 7 =?' C5 ' 5G ' ?B= G @' @ 7 ?67+ ' >I @ ?A ' 5?@' 7F ' C5 ' ?= ' ?@ 657 =?' =B' 6=?@5 ' 5I 6 ' I>7' 7F ' 6F +@' @ @' B =G ' 6=?^ E>+ =? ' + = ' ?' <,,, ' 7F ' +=65+ 6=?@ 7 =?' F5@' \> 7 @' @=C ?' = ' 7F57 7F ' E566 ^ ?57 =?' 7 ' C ' E ' G5+ ' 5?@' 65II @' =E ' 5?@' 7F ' C ' ?= ' ?@ 657 =?' =B' 6=?@5 ' 5I 6 ' >7' 7F ' 6F +@' F5@' >?] ' ?7= ' 5 ' 6=?@ 7 =?' =B' G5 5 G> ' C 7F ' E=G 7 ?A ' 5?@' +577 + ' A ?' +== ' E56>57 =?' F5@' I ?' D ?7 ' % ' >66>GI @' 7F ' @5 ' 5B7 ' ' 5C F G

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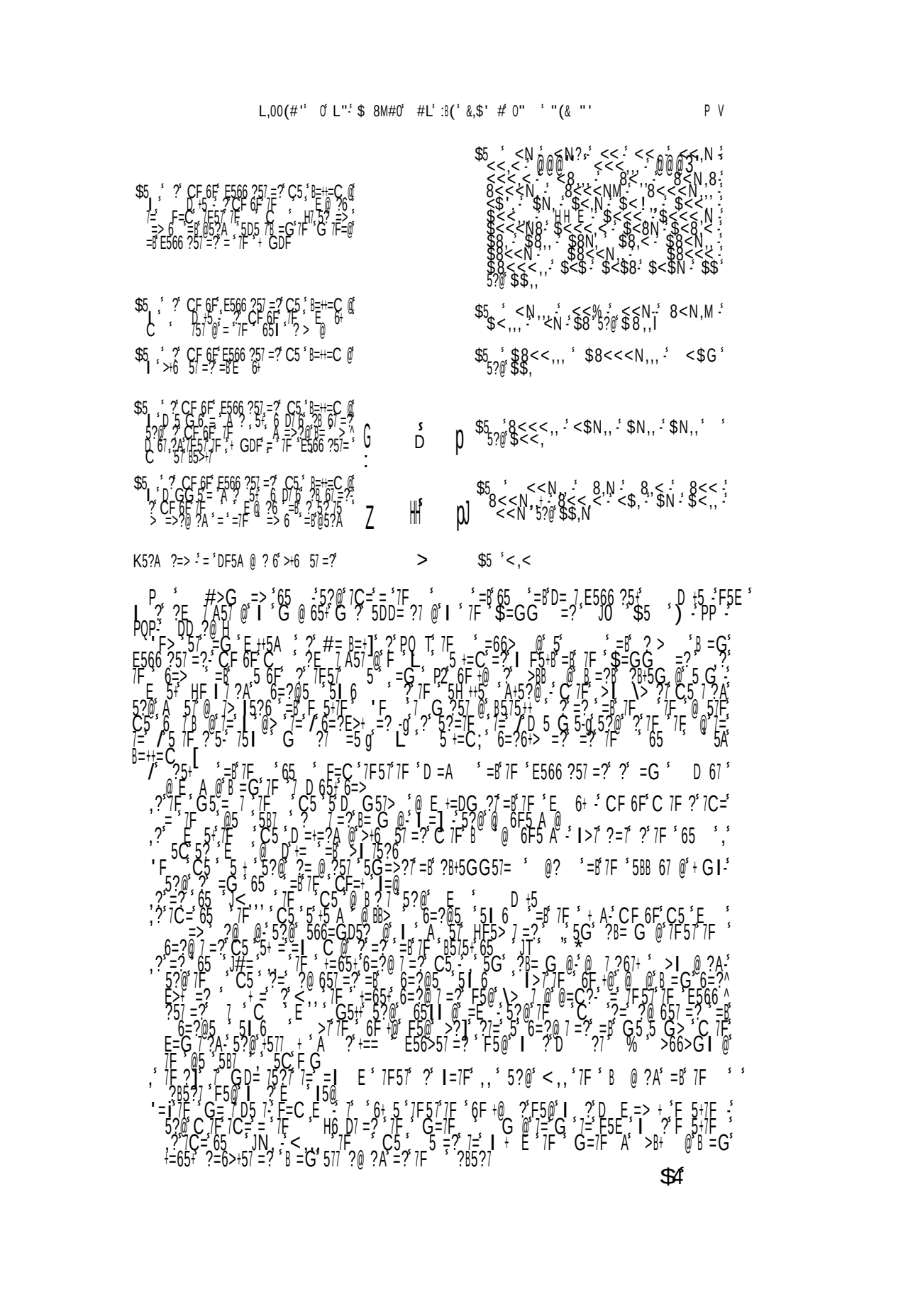

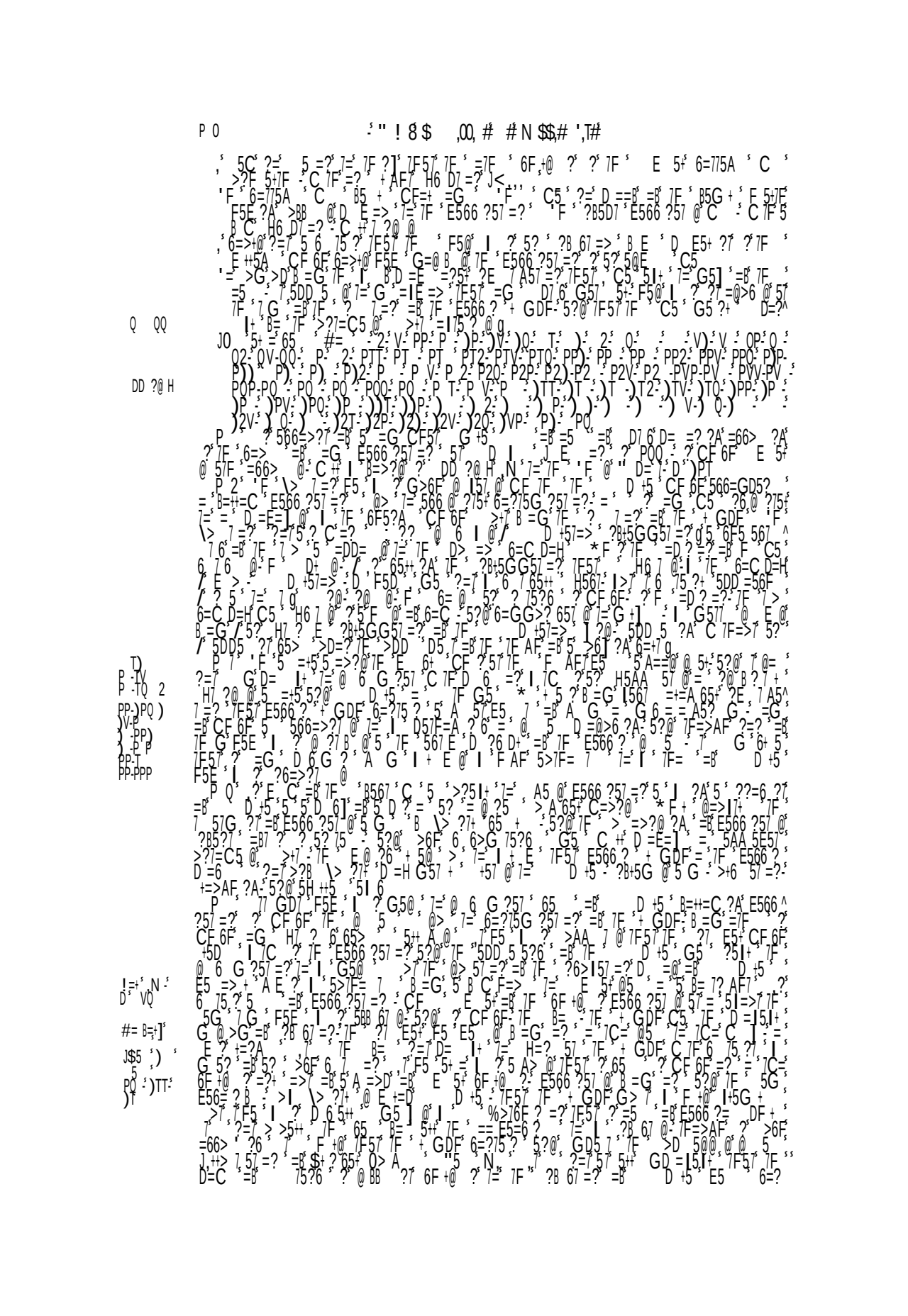

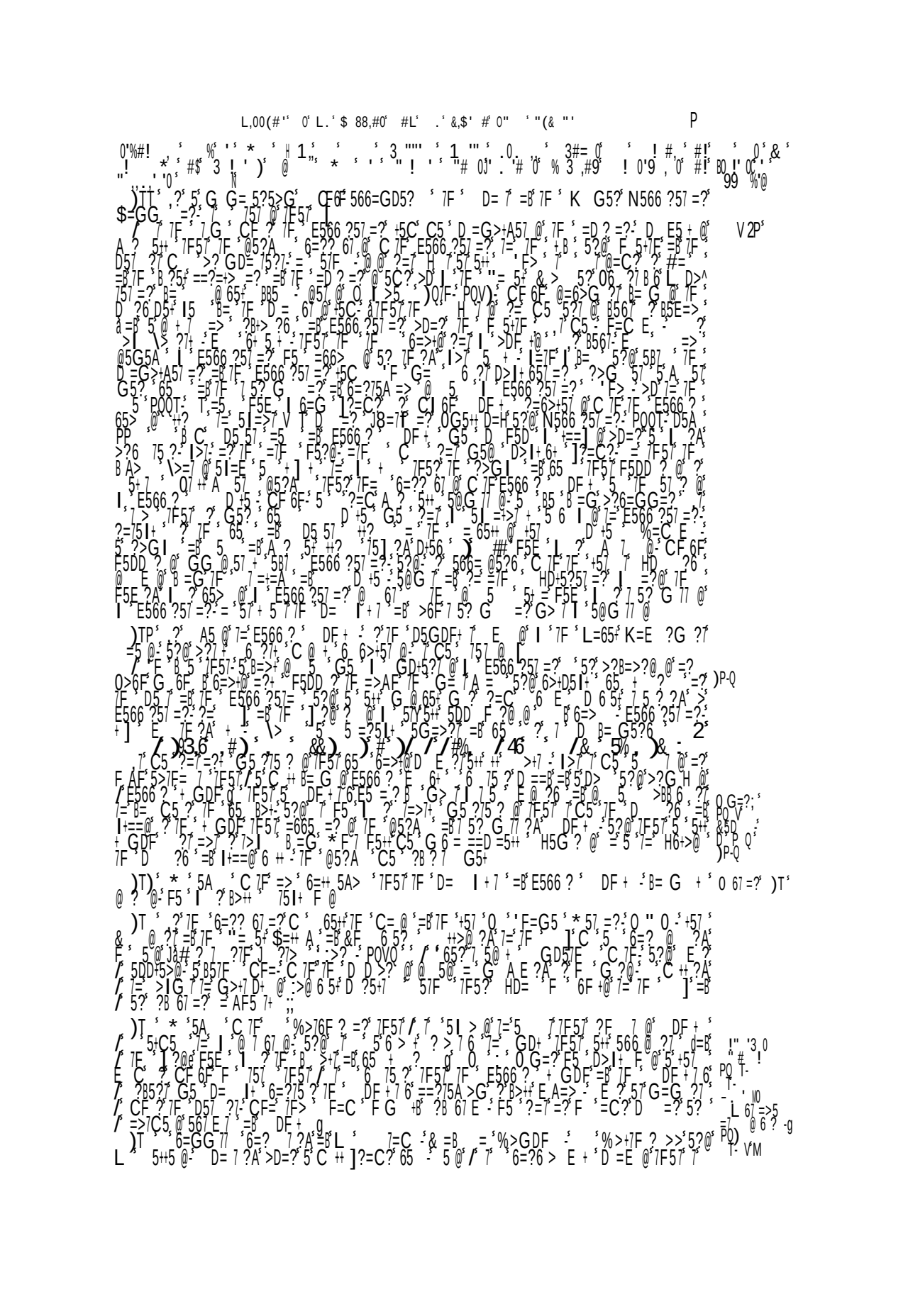

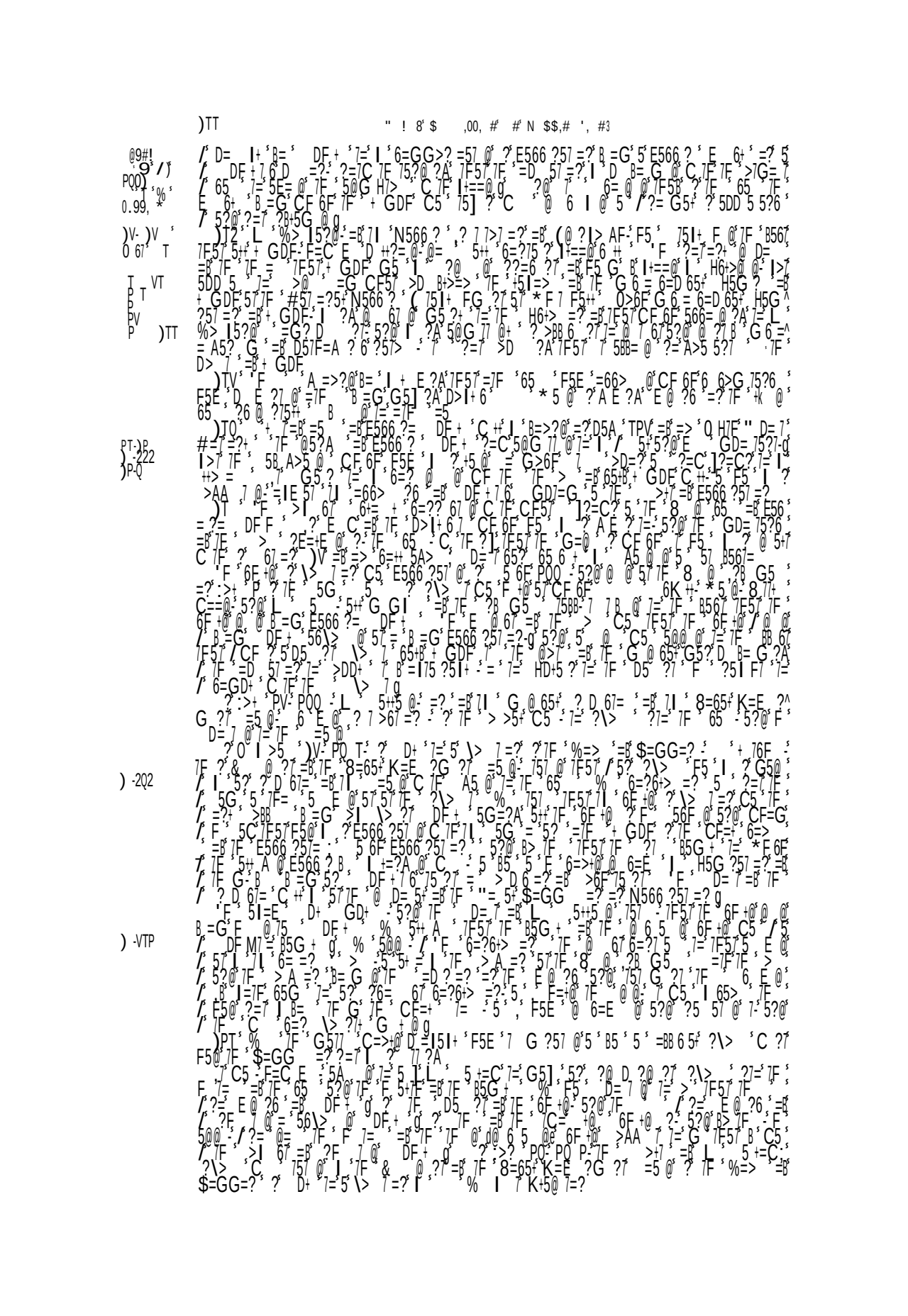

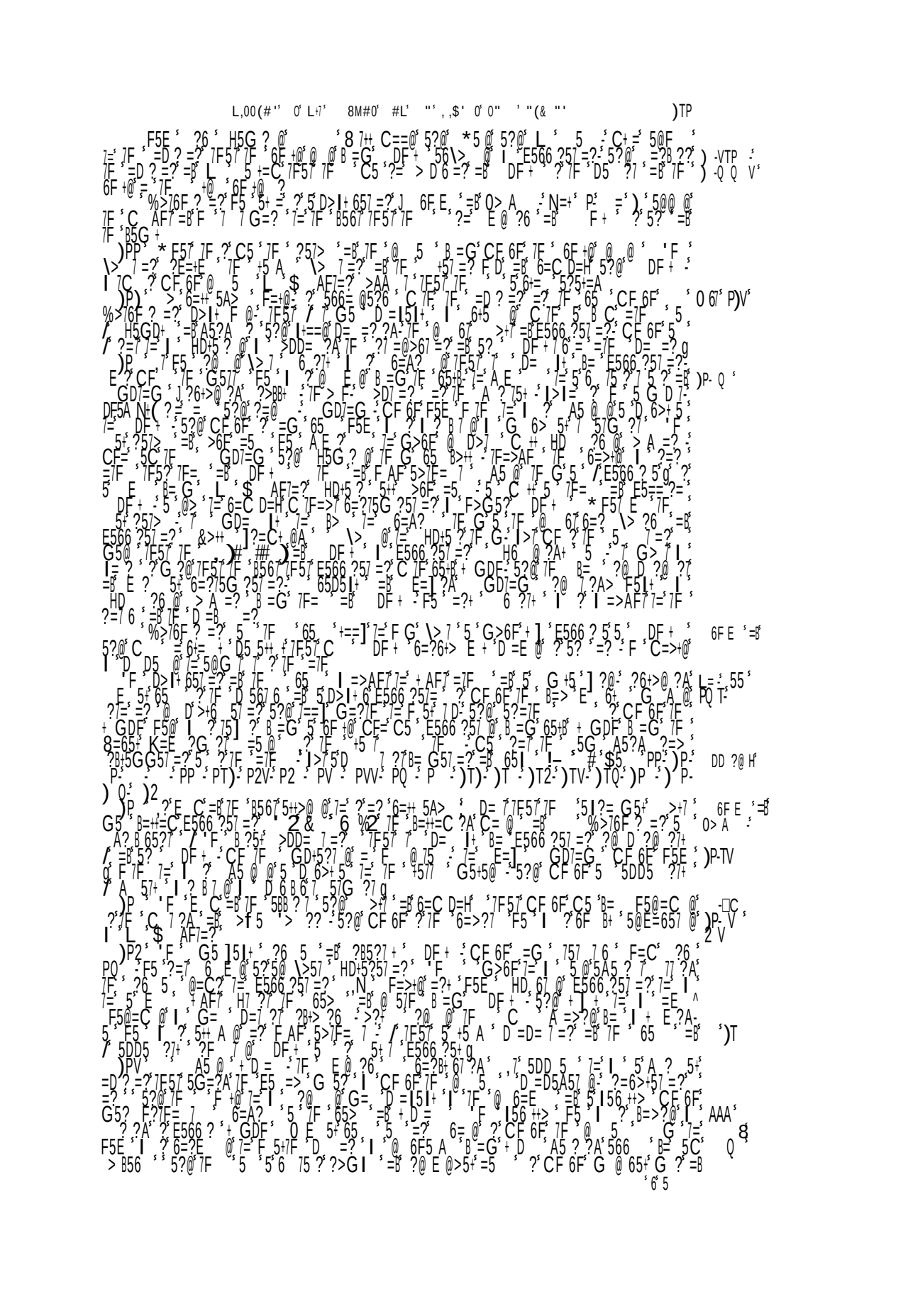

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P -P2 2
PQ-PT2

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A ,7 ' I ?' 7 G @' &&) / # 'F G5 ' I ' = =+=> - = D5D>+5 J8 6F ?' = & > A=
= 6f G57=> = GD 7 A ?=> ?' 7 D JO=> ? - 8 q=? > +5 O DF + N566 ?5+ -
DD' P) 'F G5 ' I E ' 7 5? ?' 5?@' 7 E 5+- = G5 ' I 6=G 6F =? 6 5?@' D ^
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)P ?' B ?6 '7= "7F D= I + 7 ' =B' 6=? >GD7 =?- 7>I 6+ ' =' 6 =B>+5' I ?A' 6=G^
G>? 657 @' =' =665 =? @' I E566 ?57 =?- 7' ? 6 5 7= I 5 ?' G ?@ 7F ' D E5+ ?7
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B=>?@' 7F57 7>I 6>+5 ' @ 5 5 65?' I 5@ + 6=?E @' B =G' ?B 67 @' 5? G5+ ' 7= E 5+7F '
5? G5+ = D =? I ' 7F ' G @ >G' =B' ?B 67 @' 5? G5+ D =@>67 >6F 5 G +I ' G '
7F57 ?' 5' B C' 65 ' 5' +=65+' @ E +=DG ?' =B' 7>I 6+ ?' 7F ' B= G ' =B' +>D>' F5' 75] ?'
D+56 ' 57 7F ' 7 ' =B' E566 ?57 =?' !# 65)2- 5+ = E @ ?6 ' =B' L 5] ' N (0D= 7-
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?B 67 =?' =B' 7>I 6+ F5 ' ?=' 7 I ?' E=] @' I E566 ?57 =?' ?' 5 +5 A ?>G I ' 65
7 >G=> GD7=G -'B=++=C ?A'>D=?' 7F @' 7>]5?6 ' =B' F 5+7F =665 ' =? @' I E566 ?57 =?-
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G5?? ?' 5 + 7 ?B5?6 7 B= 7>?57 B' 6F +@ ?' 65D @' 5 ' D5 7 6>+5 + ?
7F B 7 5 =B' 7F +B -' @>' ?A CF 6F I B5 7F ' G= 7 5D @' @ E +=DG ?7 =B' 7F
I=@ 75] D+56 - 5?@' CF ?' I B5E=> 5 I+ ' = ' >?B5E=> 5 I+ H7 ?5+ 6 6>G 75?6 7F
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F 5+7F (E ?' E566 ?57 =?' G5 - I 7F ' B I + @ 7> I5?6 D 6 @ ?A 7F ' >D7 =?- 5 '
C ++' 5 ' [7F57 566=GD5?' ?A' 7F >DD> 57 =?- I=7F =B' CF 6F 5 ?' E ' 5] ?7' 5?@-
566= @ ?A 7= G ?>G => 7F G=G 7 65+ =I E5?=? - =G 7 G ' 56F 5 E ' F AF
@ A - 6=? @ 5] + C 5] ?- G= ' D 6 5++ 7F= 6F +@ ?' CF= 5 ?=7 E 7 =?A-
5?@' G5 + 5E I F ?@ 7F ' A G ' =B' 5 @ D= 7 =?' 7=' ==? >G 7 =? g

))-VP

F HD G ?7 =B' = 5 ?7 ?@ 657 7F D= I + 7 ' =B' ?=6>+57 ?A' 7>I 6+ '
>D=?' 5? G5+ ' I E566 ?57 =?' = D5D L L>G=?7D5++ - =?' 5 =B' 65 >5+7
B =G' E566 ?57 =?' ?' &5 ?' 7F ' / ++5D D= 7 ' > ' + E566 ?57 =? ' D 57 \> ?' Q 5?6 -d
PQV - 7 ?@ 7= >AA 7 5' G +5 ' D= I + 7 ' ?' 7F ' F>G5?' >I 67 * F + ' 65 B 7F
] ?@' C=>+@' 5DD 5 7= I 5 - C ' F5E ' + 77+ @=>I 7F HD+5?57 =?' \>=7 @' B =G'
L #' G C=>+@' F=+@' A==@' ?' 5 +5 A ?>G I =B' 65
)T' C ++' F5E I ?' =I E @' 7F57 7F @ 5 CF 6F F5E ' I ?' 5++ A @' 7=' F5E ' I ?'
6=?E @' I E566 ?57 =?' 5 ' 7F= CF 6F G=@ ?' D57F=+=A F5 ' F=C?' 7=' I =6>+5 * '
5?@' C 5 [=>?@' 7=' 6=?6+>@ 7F57 7' D= I+ ?' 7F ' 567 =B' E566 ?57 =?' 7=' 6=?E
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5?@' C ' + E 7F ' A ? ' 5+ GD =E G ?7 =B' 7F D?I 6 F 5+7F CF 6F 7F ?' 7 ?' C5 '
@>' ? 5 ' 5 A ' G 5 > - 7= 5 A 57 5? 75 ' 567 E 7 ' 5?@' 7F57 7F ' B5++ ?A' =BB ?' 7F '
@ 57F 57 =B B E 5?@' G5++ D=H' 5 ' C ++ 5 ' ? 7F ' A ? 5+ @ 57F 57 - 6=?B G57= '
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?A' G ' + ' =B @ 5 ?5A ' GD =E G ?7 ' I>7 C ?6+>@ 7F D E ?7 =?' =B' =E 6 =C@ ?A' ?'
5 5 - = C 7F ?' F=> 5?@' ==G - 7F D =D 6=? 7 >67 =?' =B' @C ++ ?A - 5 7=
D G 7 7F= =>AF E ?7 +57 =?' 7F D =G=7 =?' =B' 6+ 5?+ ?' I ' 5@ \>57 C57 ' >DD+
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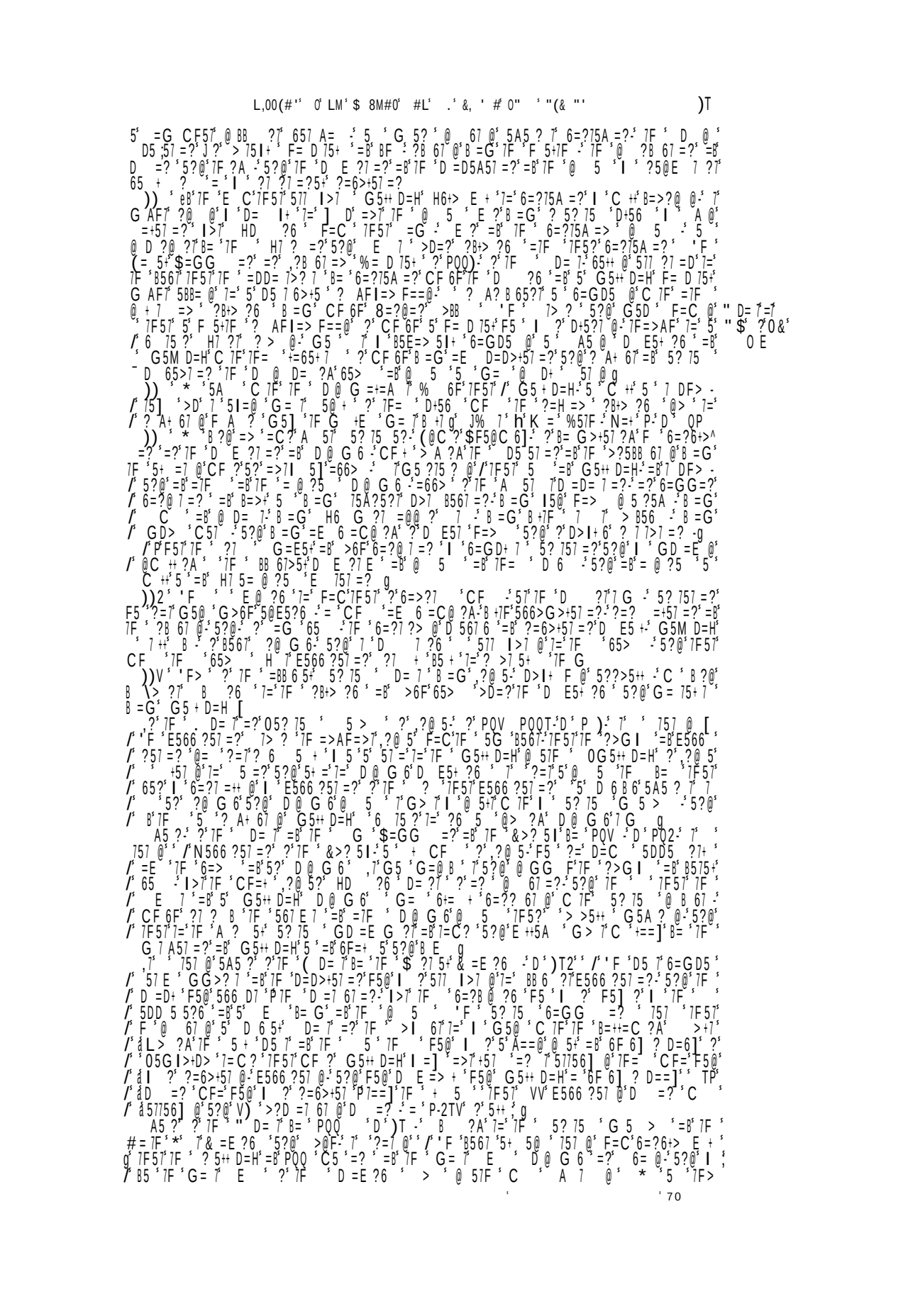

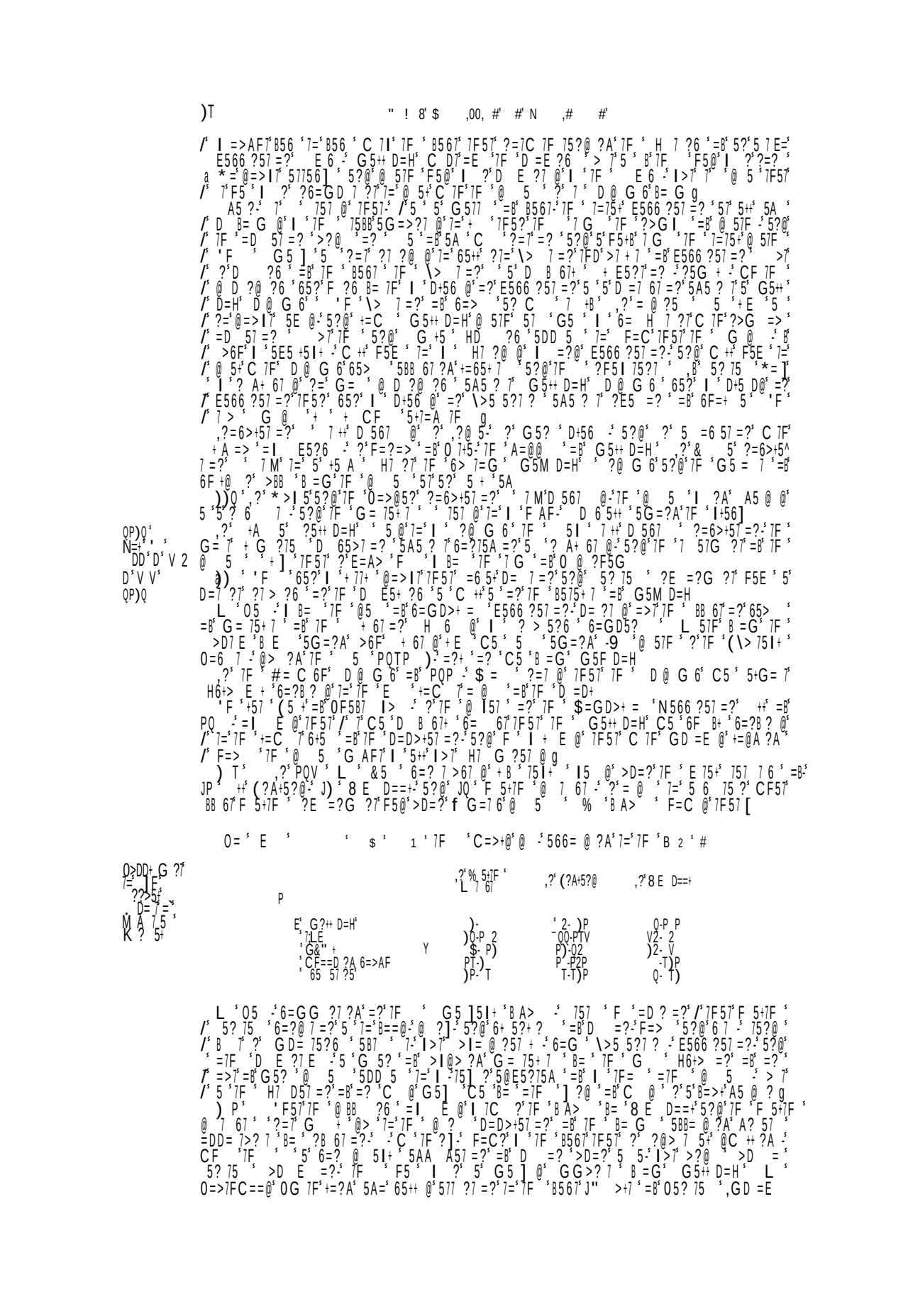

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=B' % 5+7F-' 5 -' /' % 5 @' 7F ' 5>7F= 7 ' 57' I5? -' GG @ 57 + ' =? 7F ' F D ;' 5 E5+-'
/' G=E @' 7F ' G5++ D=H' D57 ?7'7=' 7F ' F= -' 5?@' > 75I+ ' @ ?B 67 @' 7F ' F D-' 7' '
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/' ?6 ' ? > @' G AF7' F5E ' I ?' 5+G= 7-' B' ?='7' 5+7=A 7F -' 5E 7 @ g
' F 'B567 ' @=' ?='7' 5DD 5 '7=' > ' 7=' ?@ 657 ' 7F57' G 5? '=7F ' 7F5?' E566 ?57 =?' F5E '
?='7' 5' E ' D=7 ?7' ?B+> ?6 '=E ' 7F ' D 5@' =B' G5++ D=H' 5?@' ?' 7F ' D5 7 6>+5 '65 ' 7'
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7F '+5 7' F>?@ @' 5 -' F5 ' 5' G = 7' GD= 75?7' I 5 ?A' >D=?' 7F ' F 7= '5?@' G=@ ' =B'
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7F ' %=> ' =B' $=GG=?' 5 @-' /' B' C ' C ' 7=' D 6 I ' 5' G=@ ' =B' D 5@ ?A' 7F '
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/' F= D 75+'7=' 7F ' 5G=>?7' =B')-TTT' ?'5' 5 -' 5?@' B= '7F ' =>7 D57 ?7 ' 7=' 7' 7F
/' 7C 6 '5' C]'7=' I ' ? D 67 @ g' ' F ' =I 67 =?5I+ ' D 567 6 ' =B' ?=6>+57 ?A' =>7 D57 ?7 '
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HD= > ' G AF7' I ' @ 5+7' C 7F' I ' ?@ 67G ?7' >?@ '7I ' 6=GG=?'+5C
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HD= > '=B' 5' G5M D=H' D57 ?7' 5B7 ' ?=6>+57 =?-' CF I ' + E ?' D =?' C ' ?B 67 @ '
'F '$=> 7-' ?' E C'=B' 7F ' I ?A' 7F ' B 7' ?@ 67G ?7' =B' 7F '] ?@-' ?7 ?6 @' 7F ' =BB ?@ '
7=' =?+ ' 7F ' G=?7F ' GD =?G ?7
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G @ 65+' G ?' ?' A5 @' 7=' D5 7' D+5 @' I '6=?75A =?-' 5?@' 7F B= '5+ =' ?' A5 @' 7=' 7F '
5G ?5I + 7 '=B' D @ G 6 '7=' F>G5?' ?7 B ?6 -' % ' 67 =? ' 2 Q' ?' 7F ' D= 7' =B'
=> '6=++ 5A>
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5' ?=7' =?+ ' B>?@5G ?75++ ' C =?A' ?' D ?6 D+ -' ?' 7F57' 7 7 ?@ @' 7='] D' 5+ E ' 7F '
6=?75A =?-' I>7' 5+ =' 5 '5'B5 +> ' ?' D 567 6 -' ?' 7F57' 7' I5@' 567>5++ ' ?6 5 @' 7I ' F5 '
=B' 7+ '7=75+' G= 75+ 7 ' I= ? ' I ' 55++ D=H ' % ' D =D= @' ?' PVT ' 5' 7 G' =B' =+57 =?'
?' H7 5 > I5?' F= D 75+ ' E '+] '7F57' CF 6F' C ' F5E ' ?' 5@=D7 @' ?' => ' =C?' @5 '
%5 A5 7F ' * 7 ?A '@ @' G>6F' ?' 7F '6=>?7 '5?@' 5I =5@' 7='B5G + 5 '7F 'D>I+ 6'5?@' 7F '
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7F 5D >7 6'5A ?6 -' 5+] ' ?' 7F ' 65 '=B' B E '5?@' G5++ D=H
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8 Df A-' ?7 7+ @' [/' a ?' 5 '=?' 7F 'L >7 '=B' 5?' 7=' D5 57 'D =?' ?B 67 @' C 7F'
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/' 5E5A '7F ' D ?7' 5?@' B>7> ' A ? 57 =? -' 5?@' C 6=GG 7' 5' F ?=> ' 6 G ' ?' ?=7'
/' > ?A' 7F 'G 5? ' ?' => ' D=C '7=' D>7' 5?' ?@' 7=' =' @ 5@B>+' 5?' E +' ' F ' \> 7 =?' '
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/' G5H G-' B F '$ 7' D =?' ++' ?' 5' D+56 ' 7F ' =?+ ' => 6 ' $ =G' CF 6F' 5++' 7F ' 7-'
/' D F5D ' F>?@ @ ' 5?@' 7F=> 5?@ 4-' I 6=G ' 5$B 67 @' ' + 7' F G' I 'D>7' GG @ 57 + ' ?7'=
/' 5' 7>57 =?' CF ' F '65??=7' ? > ' I ' 6=?7567' 7F= 'CF=' F5E '?=7' F5@' 7F ' @ = @ '
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/' 5?@' 7=' 7F 'F>G5?' 56 A ' =I E '7F ' @>7 'CF ?' 5' G5? 56' I 6=G ' @5?A > '7I'
/' =6 7 -' 5?@' F5++' C ' =G 7' 7' F 'CF '7I '@5?A ' ' ?B ? 7 + ' A 57 -' 5?@' D F5D '
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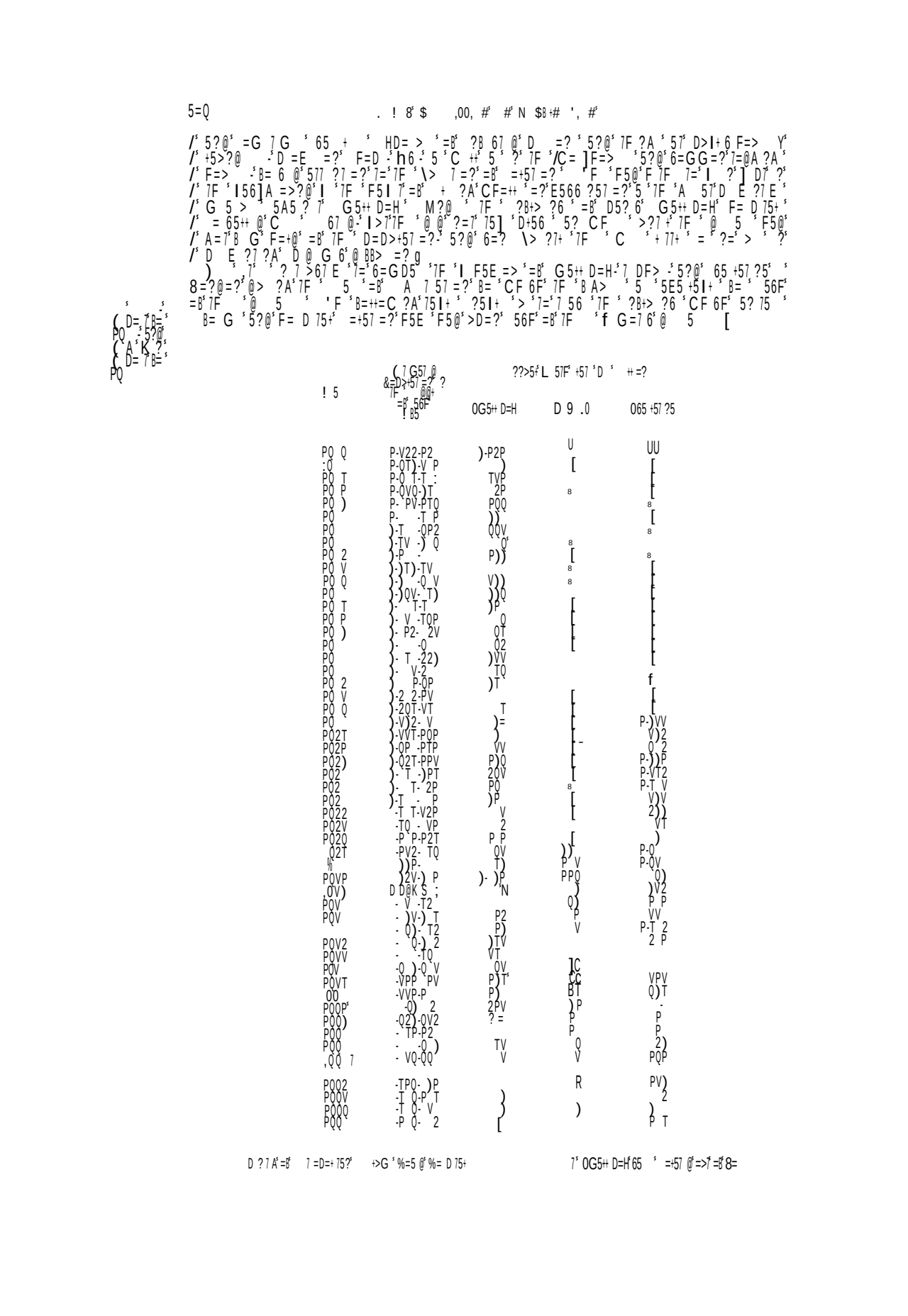

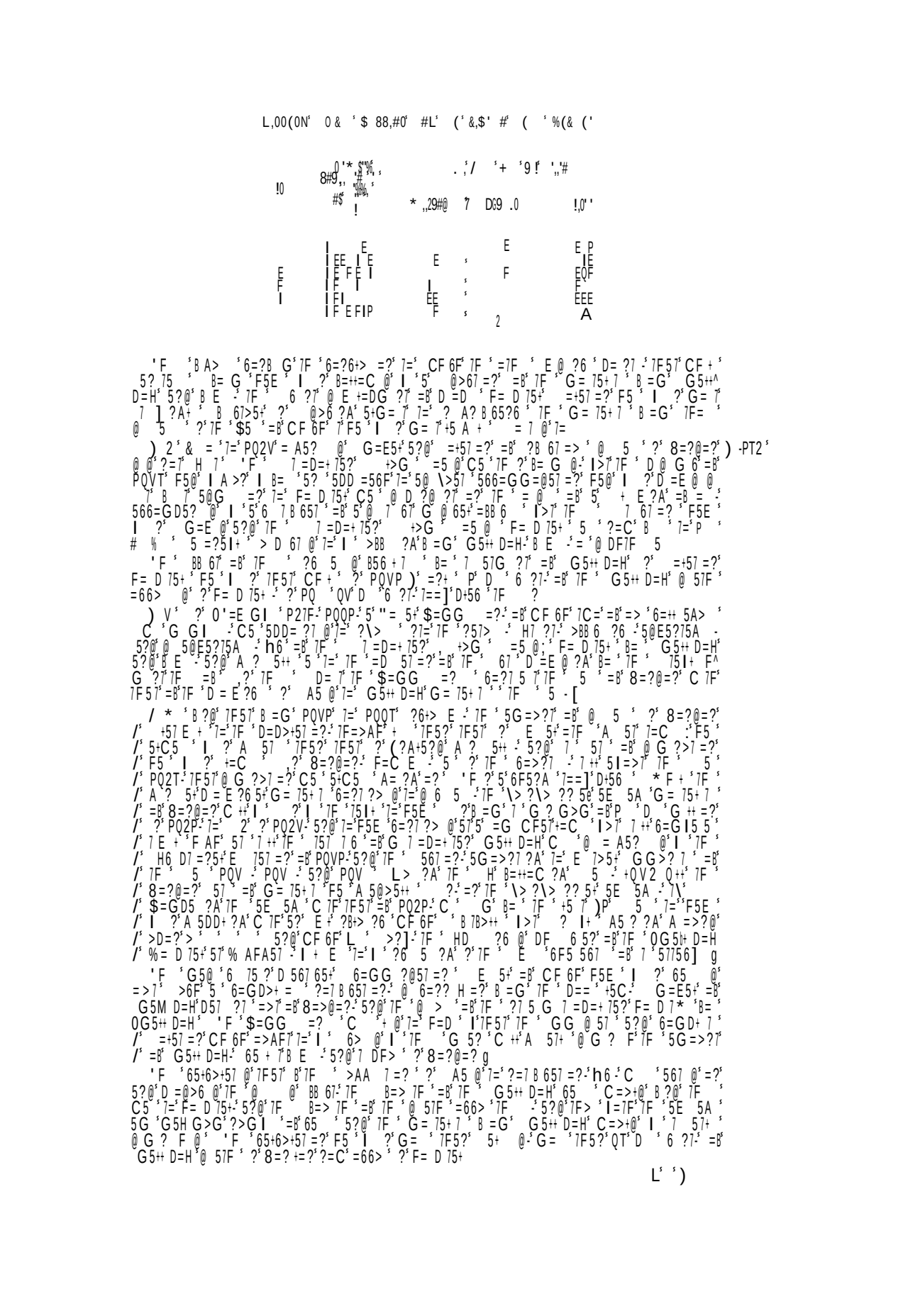

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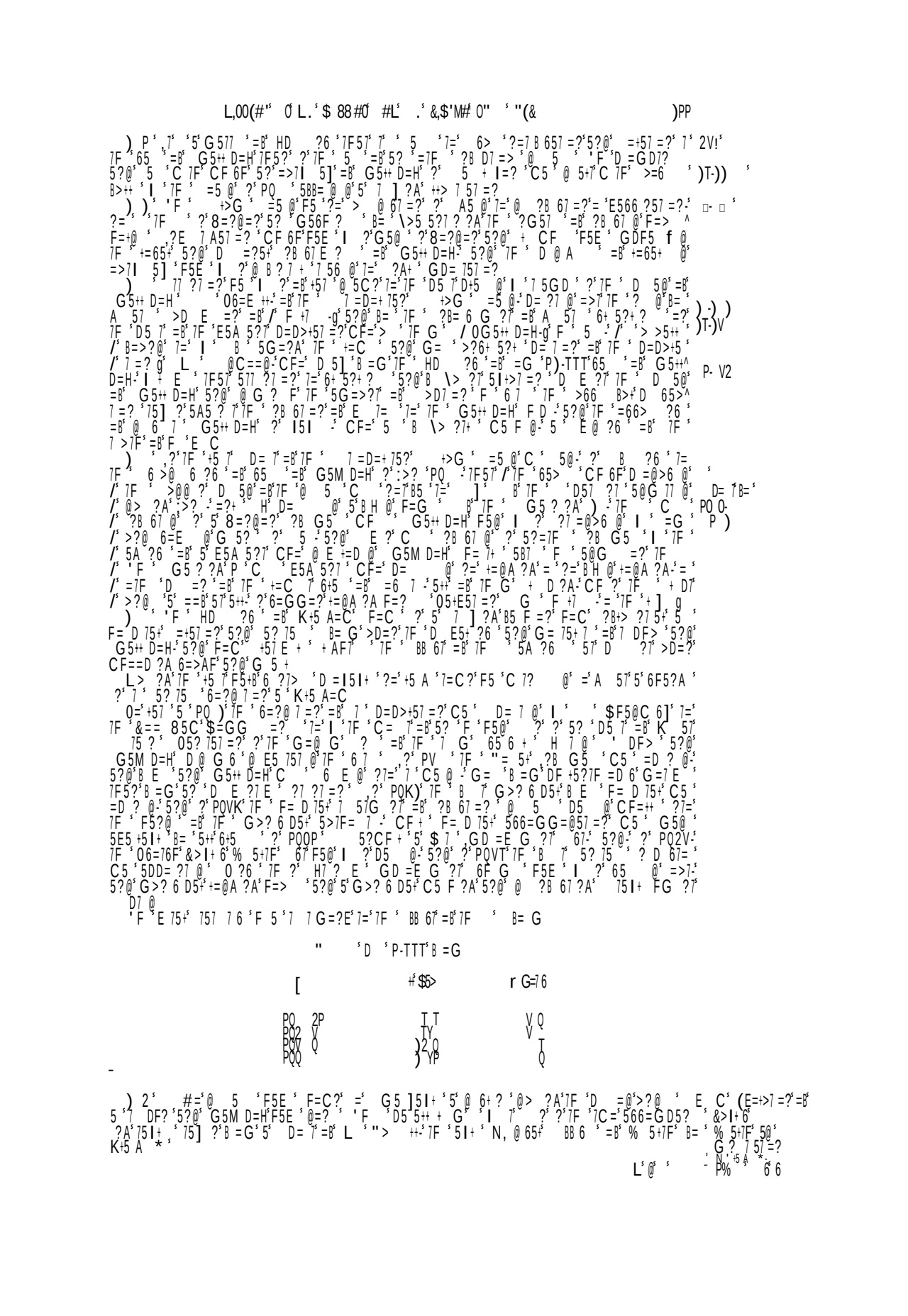

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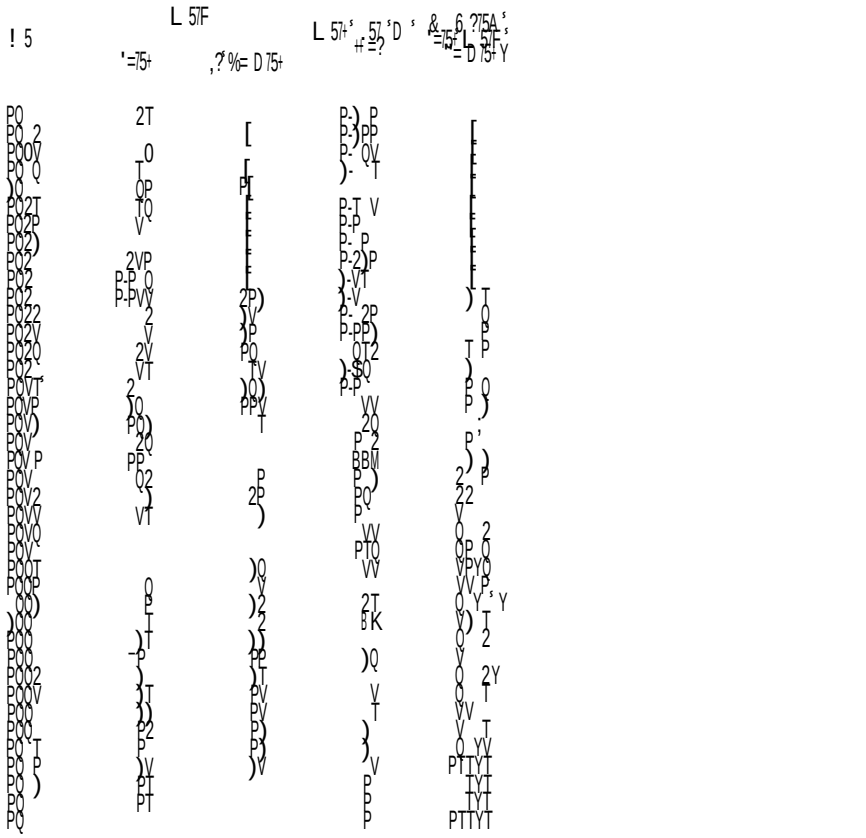

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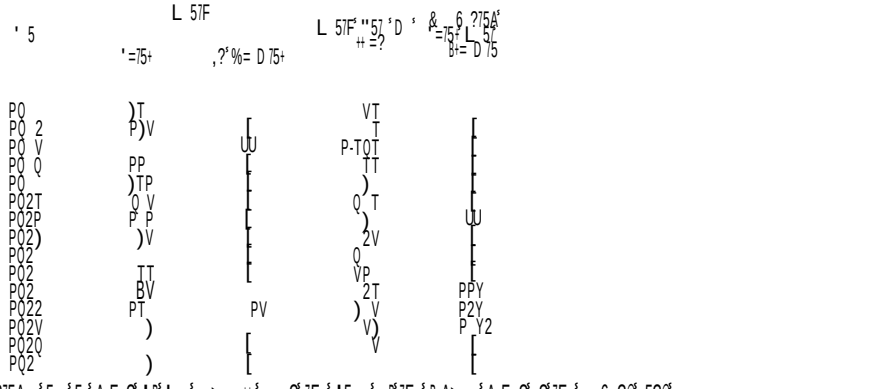

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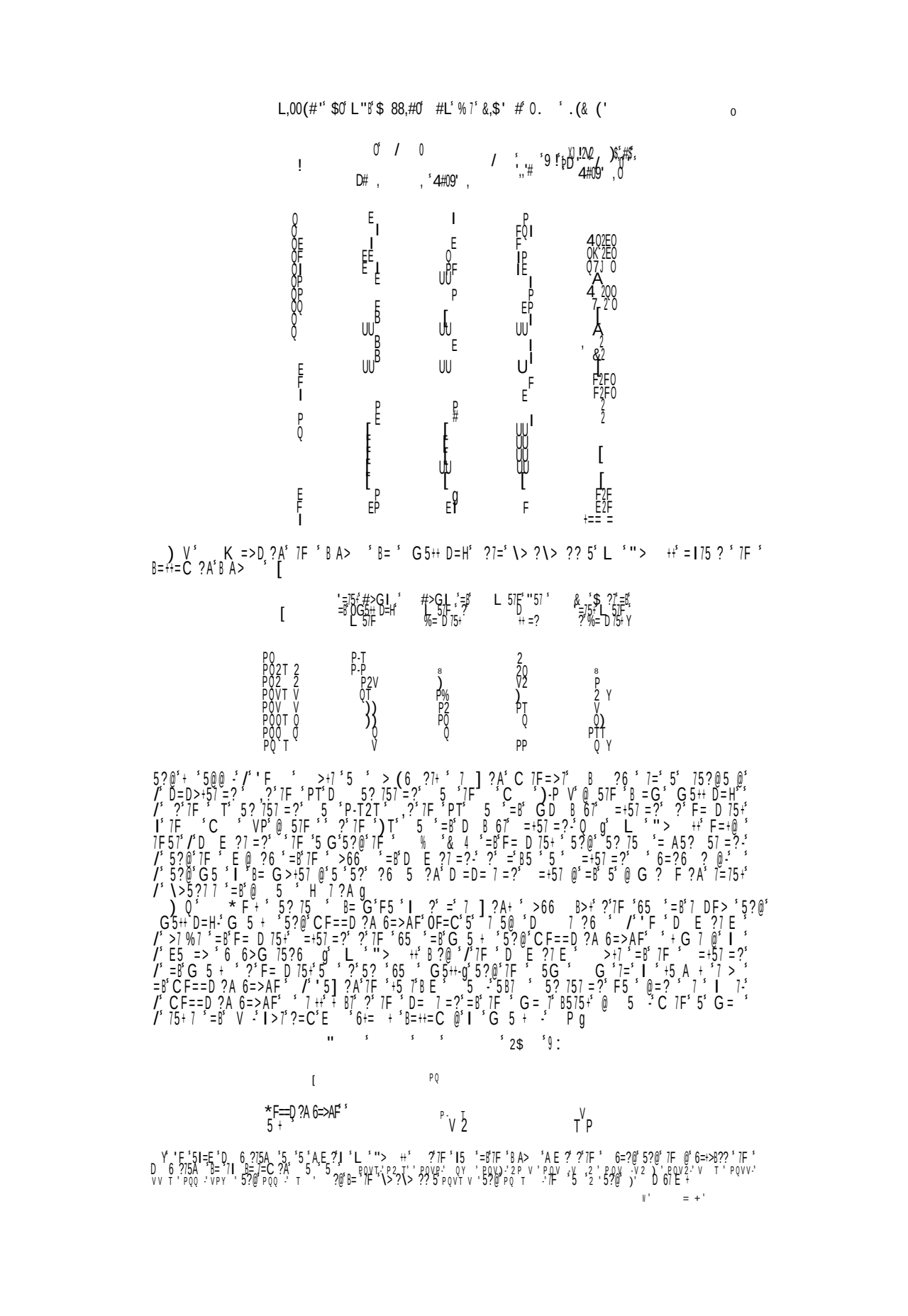

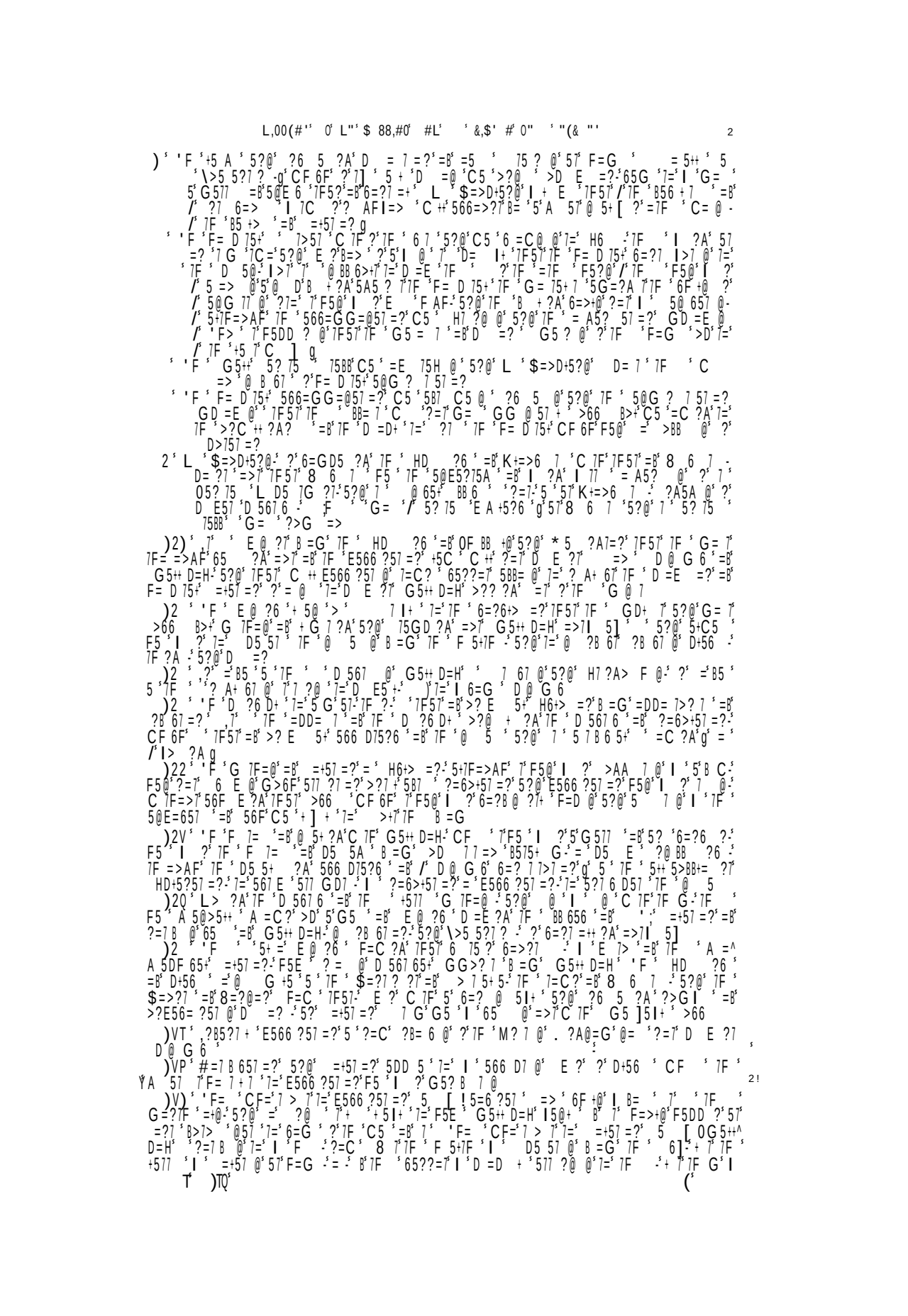

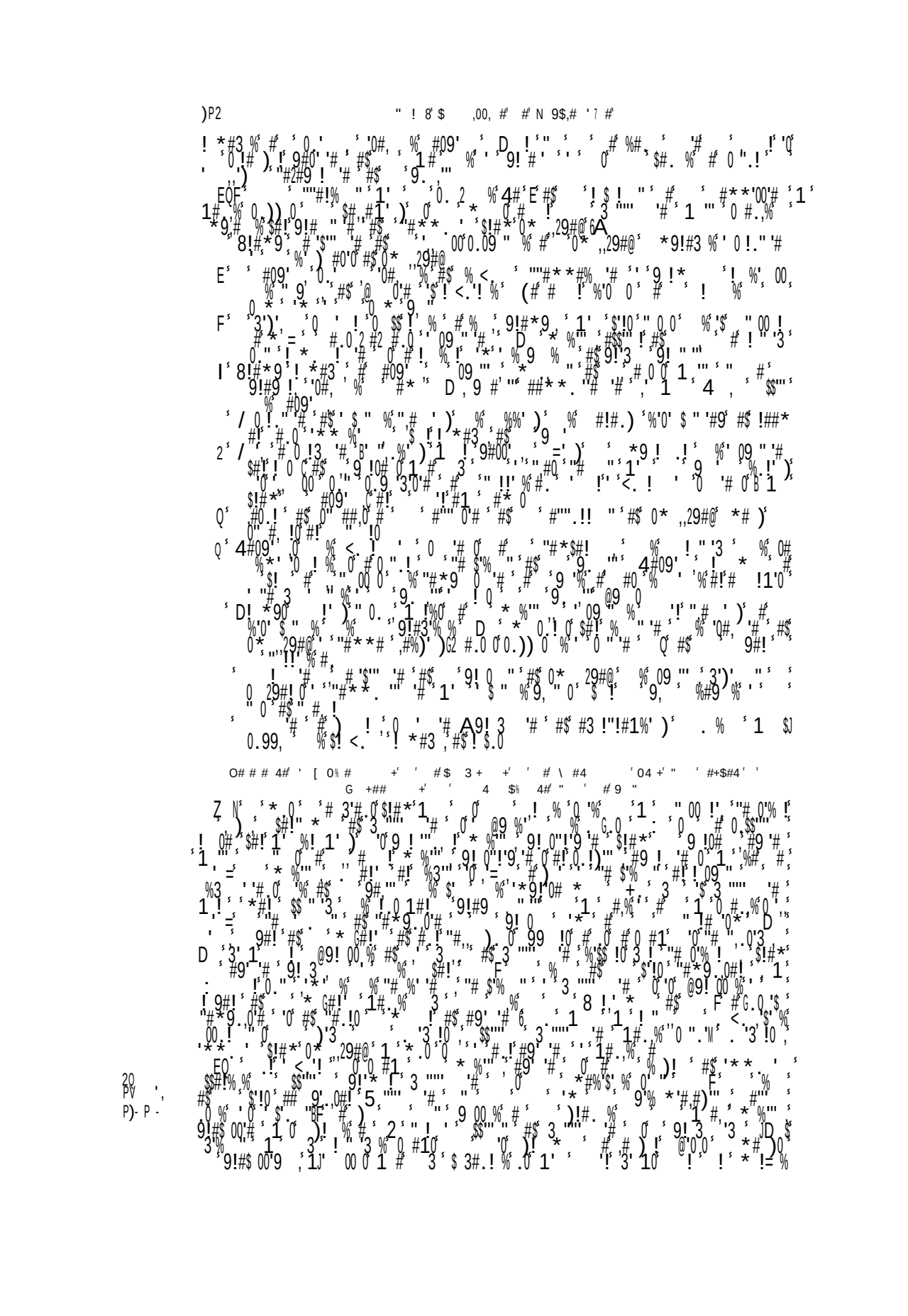

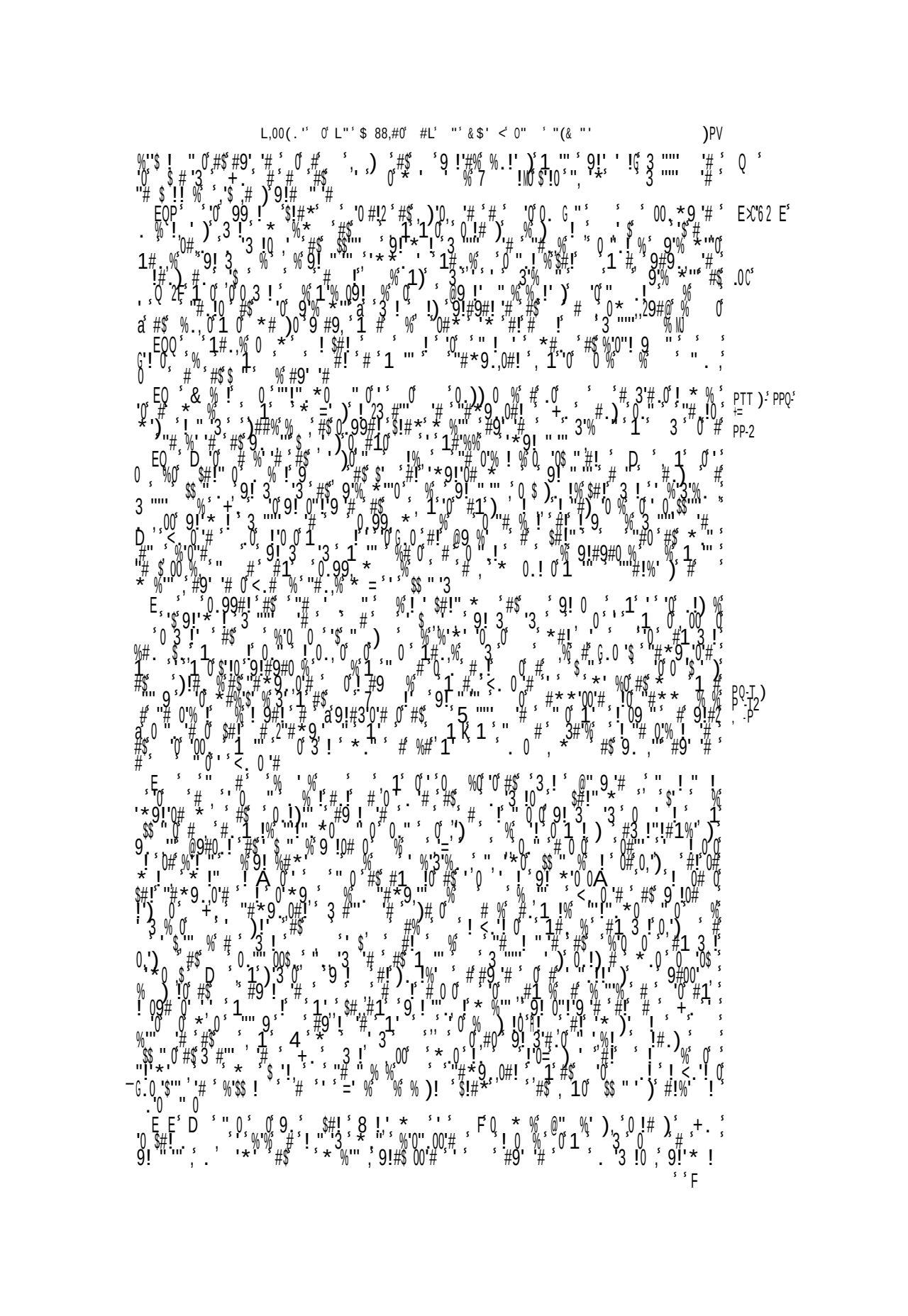

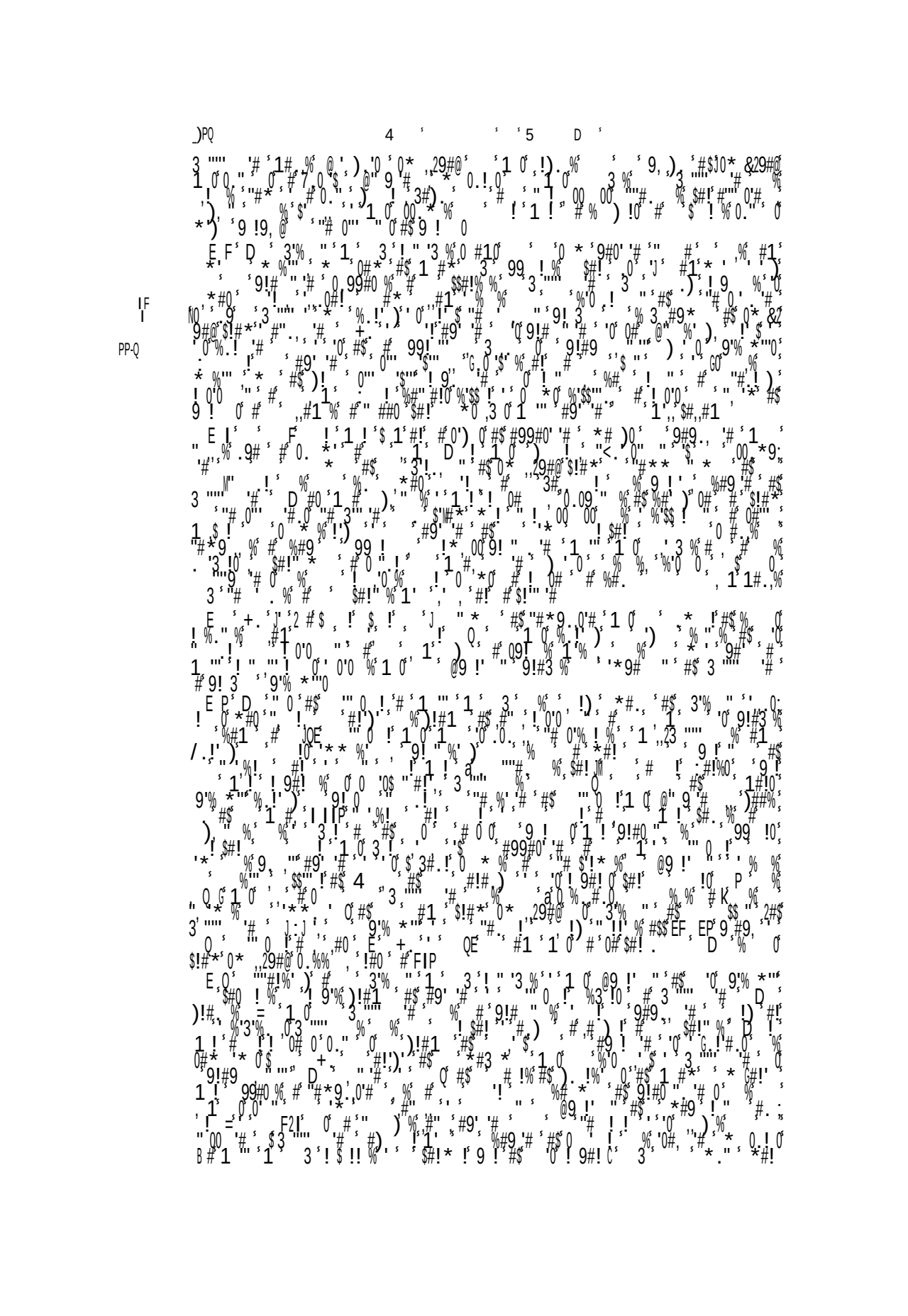

spects the law should be left as it is, subject, however, to such modifications as are recommended for the diminution of attendant risks. The precedent established in the case of the abolition of compulsory church rates might be followed with advantage. In that case all machinery for laying and collecting the rate was left intact though the power of enforcement was taken away. The effect of our recommendation, if adopted, would be that vaccination would continue to be provided as at present for those who desire to avail themselves of it, but efforts to secure vaccination would be limited to moral influence—in a word, the whole country would be in the position of those unions in which the guardians have abandoned compulsion.

302. The grounds on which we object to the enforcement of vaccination by penalties necessarily lead us also to object to any method of indirect compulsion. We regard as both inexpedient and unjust exclusion from any branch of the public service because of the refusal to submit to vaccination or re-vaccination. The injustice is perhaps most severely felt in the case of candidates for employment as pupil-teachers in public elementary schools. There are now districts in which, owing to the general opposition to vaccination, scarcely a girl or boy can be found who is legally eligible, and candidates have to be brought in at great inconvenience from surrounding districts. The existence of an exceptional case or cases in which such rejected candidates have at some time afterwards taken small-pox is in our view no justification for the continuation of this grievance. Statistics furnished to the Commission prove that large numbers of vaccinated or re-vaccinated persons have taken the disease; and we are not aware of any evidence to show that vaccinated pupil-teachers have any special immunity. If our recommendations were carried out the danger of contagion would be greatly diminished, in schools, as elsewhere.

303. On the whole, then, while there is much in the report of our colleagues from which we dissent, and we have accordingly abstained with reluctance from adding our signatures to theirs, we are at one with them in holding that it is unwise to attempt to enforce vaccination on those who regard it as useless and dangerous. We, however, go further, and agree with our colleagues, Mr. Whitbread and Mr. Bright, that it would be simpler and more logical to abolish compulsory vaccination altogether.

W. J. COLLINS.
J. ALLANSON PICTON.

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on 02 July, 2018